

CASE: DOWN OR DOWNSIZED?



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Market Analysis Program (MAP)

CASE: Down or Downsized?

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Abstract

This report provides an assessment of the current and future computer-aided systems engineering (CASE) markets. CASE involves the use of information technology to control and improve the effectiveness of the systems development process, which remains one of the major constraints to successful deployment of computing technology throughout today's modern organizations.

CASE technology exploded on the market in the late 1980s and has since faced continued challenges to attaining the level of acceptance and success that early responses suggested. This report frames the CASE market within the U.S. information services industry by providing descriptions and analysis of the current perspectives on CASE in the information systems function, the size of the U.S. market, and the forces driving and inhibiting success. CASE continues to offer great potential to strengthen the information services industry through improvements in productivity, systems quality and systems longevity. INPUT's analysis provides valuable insights for both vendor and information systems executives as they consider CASE, or as they strive to achieve the benefits successful CASE implementation offers.

This report contains 66 pages and 51 exhibits.



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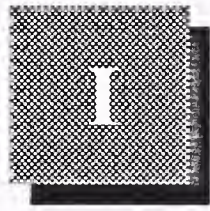
A

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Introduction

This report and the related research was performed as part of INPUT's Information Systems Program. This program serves the management of leading vendors in the information services industry and the information systems function of large organizations.

A Scope

This report examines developments in CASE (computer-assisted systems engineering) that involve the development of business systems. The main focus is on two inter-related issues:

- IS departments' requirements and plans
- Technology issues affecting the increased use and effectiveness of CASE

Based on INPUT's analysis of requirements and technology, INPUT has developed several scenarios on CASE growth for the 1992-1997 period. INPUT's forecast is for the size of the CASE product market. It is currently not feasible to measure the separate impact of CASE on other areas. In professional services, for example, the amount of pure CASE services is relatively modest; the extent to which CASE permeates other services is significant, but resistant to quantification. However, INPUT believes that the rate of market growth, and especially the development of its alternate growth scenarios, represents a good surrogate for the growth of overall CASE use.

Section C of this chapter, Definitions, defines the areas included and excluded in this report in more detail.

B

Objectives

This report will address the following issues:

- How important is downsized development?
- How will CASE function in a client/server environment?
- How effective within corporations has CASE been to date?

How will applications development change from 1992-1997?

- What are the most serious barriers to wider CASE use?
- How important are technical issues generally for CASE acceptance?
- How large is the CASE product market likely to be by 1997? Under what circumstances will it be larger or smaller?
- What impacts will CASE have on applications software companies?
- What options do professional services firms and systems integrators have in responding to CASE developments?

C

Definitions

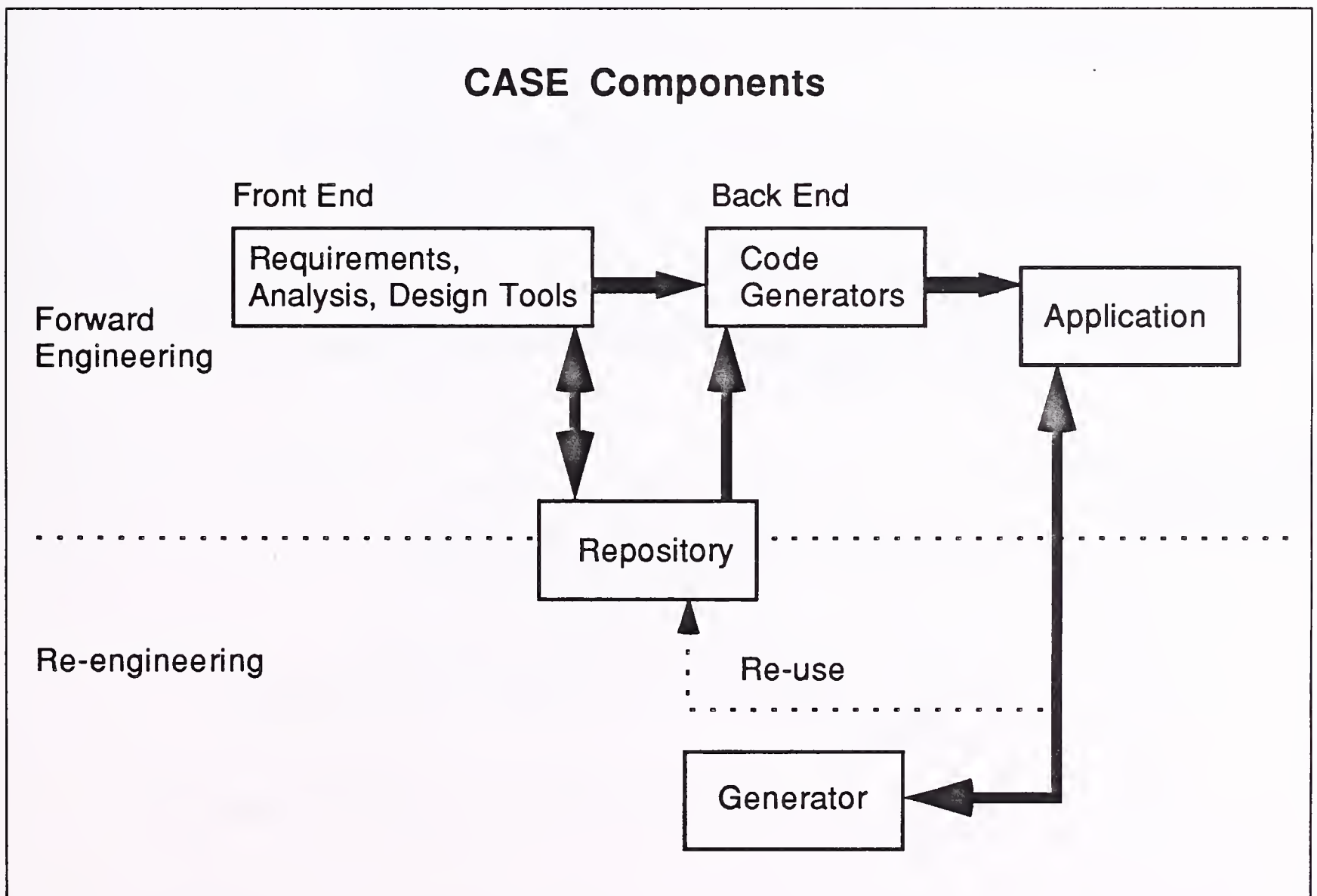
1. Terms Addressed in This Report

Exhibit I-1 lays out the major components of CASE and their relationships.

Forward engineering has traditionally been divided into:

- Front-end tools for performing requirements, analysis, and design work
- Back-end tools, or code generators

EXHIBIT I-1



2. Exclusions from This Report

This report covers business-related CASE. It does not include CASE tools/methodologies that focus on:

- Microprocessor design
- Real-time systems
- Embedded systems
- Scientific/engineering applications

In addition, this report does not include:

- Traditional compilers and debuggers
- Fourth-generation languages (4GLs)
- Data base access languages (e.g., SQL and related tools)
- Data base tools
- Project management systems

These areas are analyzed in INPUT's report, *U.S. Systems Software Products, 1992-1997*.

D

Methodology

The following sources were used for this report:

- 54 interviews with users of leading CASE products
- 67 interviews with companies on mission-critical applications development
- Ongoing discussions with over 20 vendors of CASE products and services
- Non-proprietary insights from eight custom research and consulting studies
- Ongoing interaction with technical experts and practitioners

E

Report Structure

The remaining chapters of this report are organized as follows:

- Chapter II, Executive Overview, provides a summary of the contents of the report.
- Chapter III, IS CASE Usage: 1992-1995, examines the different measures of CASE usage and concludes that the net use of CASE as well as expected future use are both relatively low.
- Chapter IV, Downsizing and CASE: Driving Forces, assesses the role of end-user departments and the impact on CASE use.
- Chapter V, Downsizing and CASE: Technical Issues, pays particular attention to the client/server environment and its use of application development tools.
- Chapter VI, Market Forecasts, provides scenarios affecting CASE growth and quantifies the size of the CASE product market from 1992-1997 under different sets of assumptions.
- Chapter VII, Conclusions and Recommendations, summarizes INPUT's findings and proposes short- and longer-term actions for both users and vendors.
- Appendixes include:
 - Appendix A—Organizational Readiness in 1991
 - Appendix B—1992 Forecast

F**Related Reports**

Please refer to the following related INPUT reports:

U.S. Systems Software Products, 1992-1997

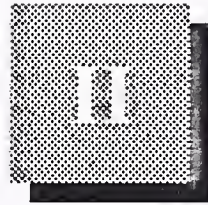
Client/Server Applications and Markets, 1992-1997

Impact of Downsizing on Systems Integration

Systems Integration Opportunities in Re-engineering

Systems Architectures for Downsizing

Putting Downsizing in Perspective



Executive Overview

A

CASE Capabilities

Until a short time ago, the capabilities of CASE concepts, methodologies and products were assessed primarily for their utility in developing new applications on mainframe and minicomputer platforms (i.e., what INPUT terms “host-led” platforms in this report).

In that context, CASE concepts, methodologies and products can be judged adequate or better.

However, host-led new applications are only one part of the challenge facing those responsible for applications.

- Maintenance for “heritage” applications is now a more strategic issue for many IS departments than new development.
- This is directly related to the increasing importance of user-led development in general and client/server applications in particular.

In these latter two areas, CASE products and concepts have much less to offer developers. CASE support for new applications in the standalone PC/workstations environment is better than for client/server applications because these are smaller applications in, essentially, a simpler host-led environment.

These relationships are summarized in Exhibit II-1.

EXHIBIT II-1

CASE Capabilities for New Development and Maintenance by Platform

Target Platform	CASE Capability	
	New Development	Maintenance
Host-Led (mainframe/mini)	Medium	Medium/Low
Client/Server	Low	Very Low
PC/Workstation (standalone)	Medium/Low	Very Low

Source: INPUT Assessment

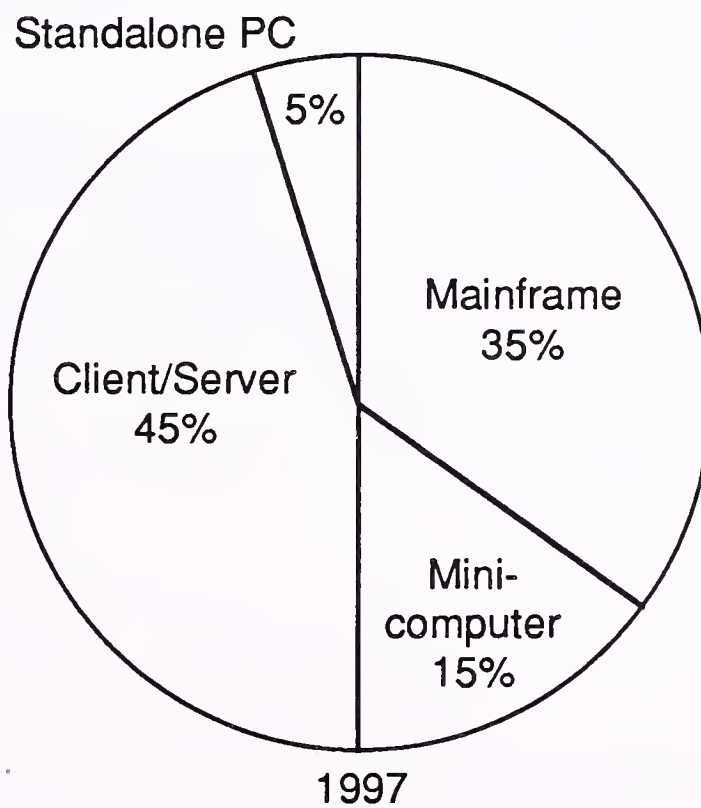
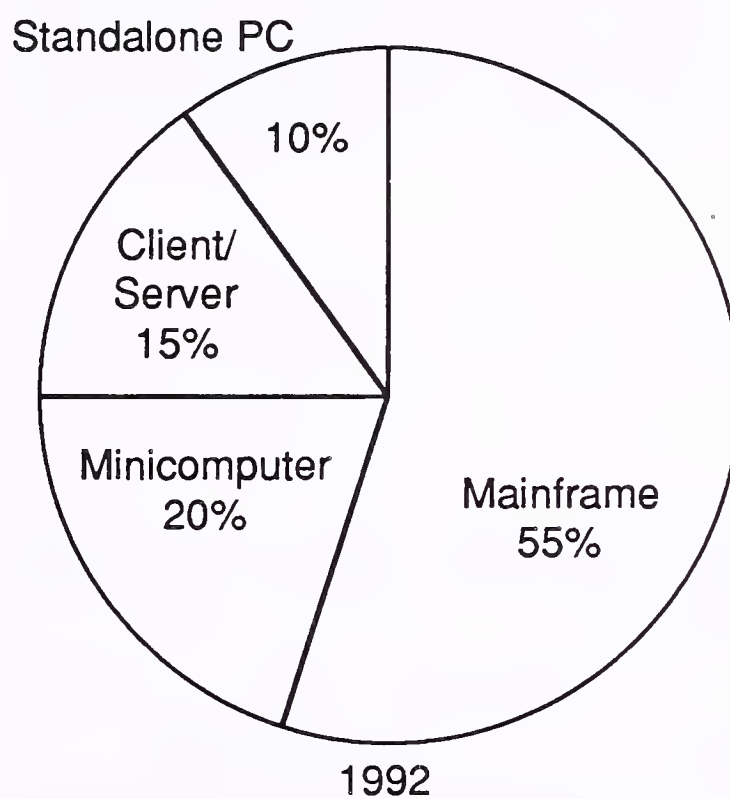
B

Target Platforms for Mission-Critical Applications

The strengths and weaknesses of CASE in different platform environments becomes very important because of the changing focus of new development. As Exhibit II-2 shows, the focus of development will have shifted from host-led (especially mainframe) environments to client/server environments by 1995.

- This shift might be even larger if there were broad-based, integrated application development tools for client/server development.
- The lack of tools will mean that suppliers of CASE-oriented products and services will have to be flexible and niche-oriented if they are going to take part in this growth.

EXHIBIT II-2

Target Platform for New Mission-Critical Applications, 1992-1997

Source: INPUT Estimates

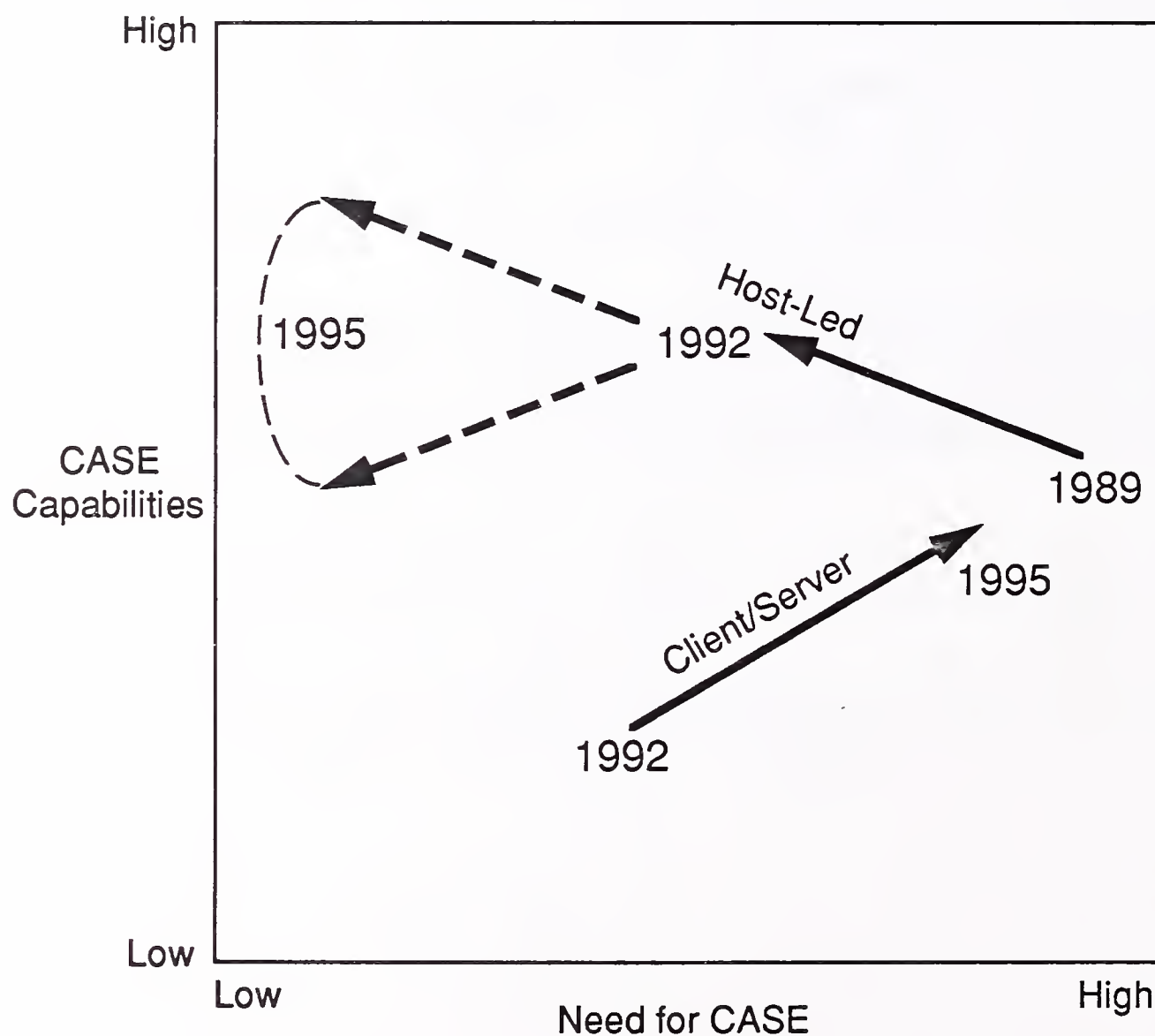
C

Future Needs and CASE Capabilities

Exhibit II-3 contrasts the need for software engineering concepts, products and services and likely capabilities on the two major types of platforms to 1995. These needs and capabilities are collectively called "CASE" for purposes of reference; in some instances, the needs—and offerings—will only encompass part of the conventional definition of CASE.

EXHIBIT II-3

CASE Need and Capabilities by Platform



Source: INPUT Assessments

- The perceived need for CASE products and services at the client/server level is reduced somewhat by emphasis on short-term business solutions and widespread ignorance about technical options among the newly dominant user community.

- In any event, technical advances in client/server CASE are expected to be relatively modest into the mid-1990s.
- Host-led CASE is in a better technical position: the payoff could be near for the investments made during the 1980s.
- The problem is that the “natural” user of host-led CASE, the central IS department, is declining in responsibility, authority and image. This raises serious questions as to the relative viability of host-led development generally and the extent to which CASE concepts and tools will be used.

D

CASE Product Use and Market Forecast

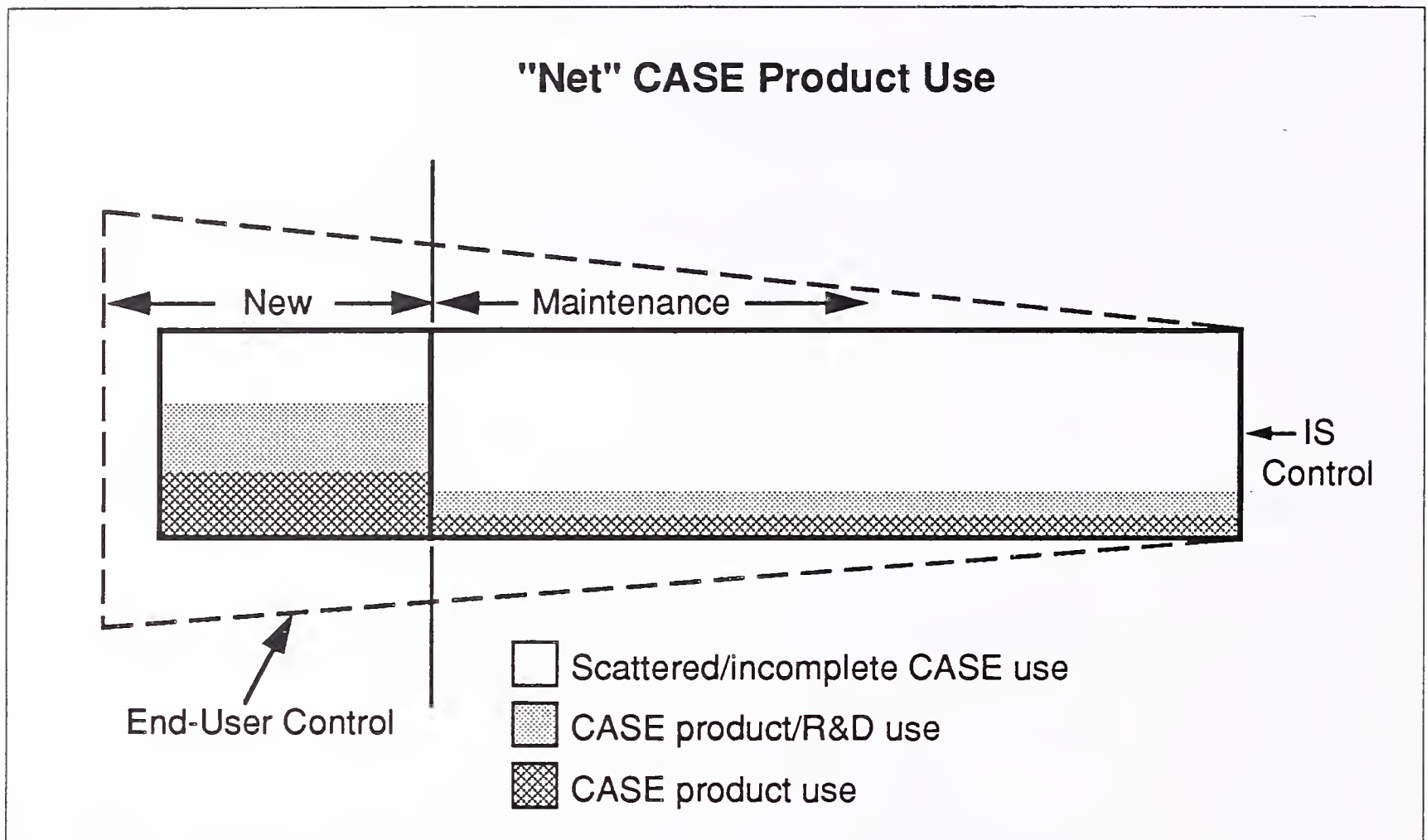
Apparent CASE product use is fairly high. For example, INPUT’s research finds that over two-thirds of the users of major host-led products are using these products for most new development.

However, “net” use is much lower.

- New development is only a minority activity in most IS organizations. “CASE” products in maintenance environments are much more limited in scope and are not used as much.
- Many IS organizations are still in a self-described R&D environment in regard to CASE.
- Most importantly, much of development is taking place outside of the central IS group: CASE products are used much more in the traditional central IS department.

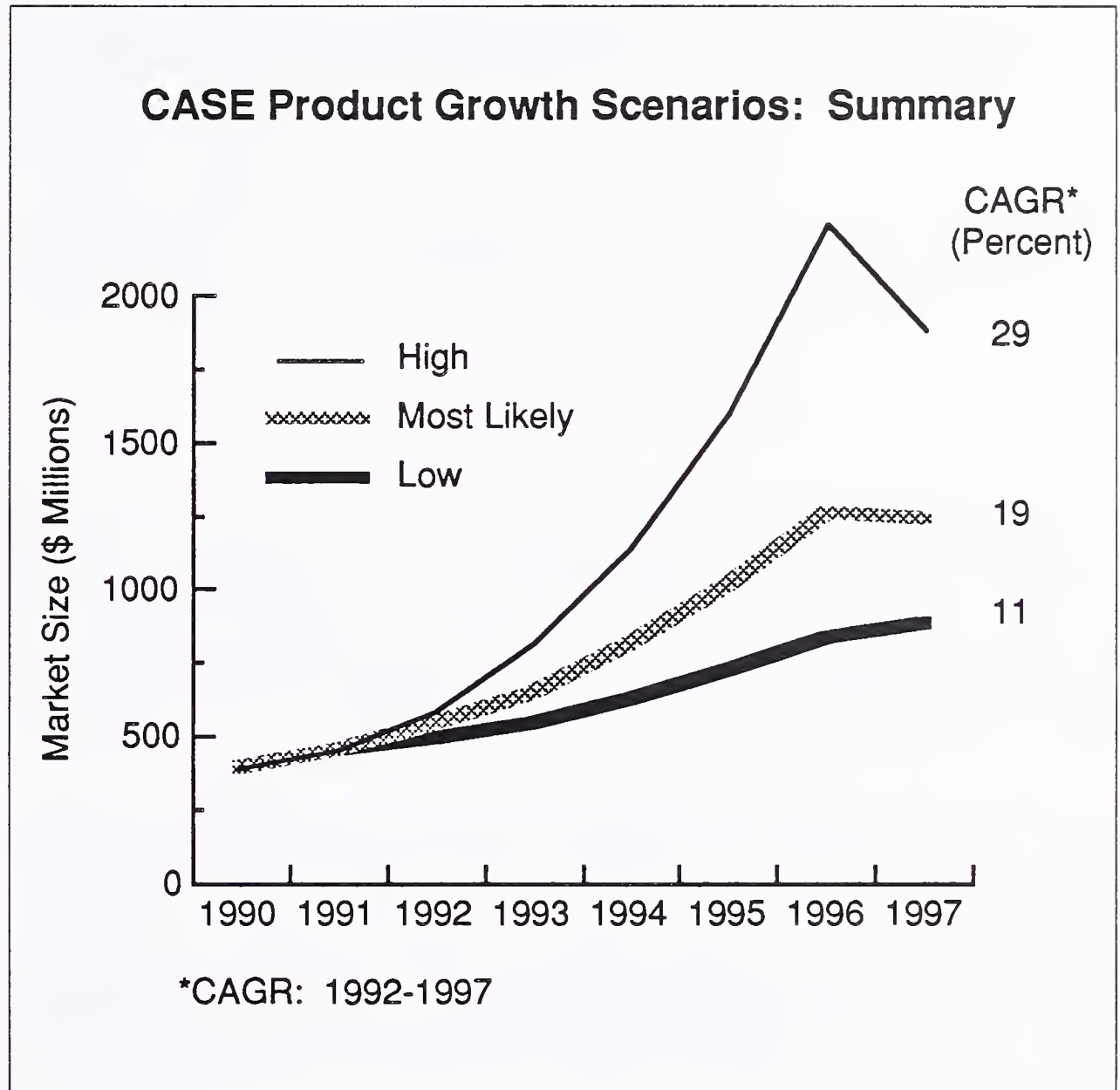
Exhibit II-4 shows in schematic form the net penetration of CASE products.

EXHIBIT II-4



These factors combine to both place a ceiling on CASE product growth as well as to introduce considerable variability in forecast factors. The mid-point growth curve in Exhibit II-5 is the one that INPUT considers most likely. However, growth could be considerably higher or lower depending on how well CASE is accepted in user organizations and, especially, how much technical improvement is made to client/server tools.

EXHIBIT II-5

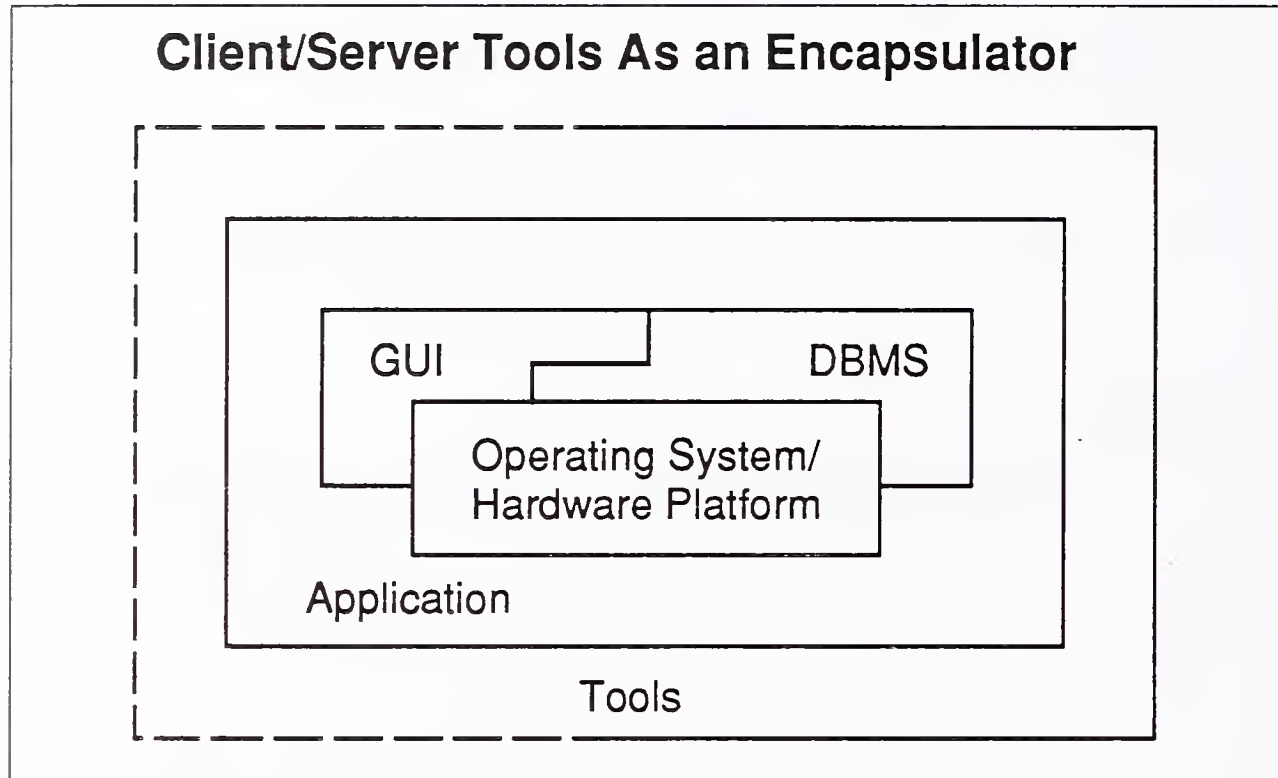
**E****Client/Server Development Tools**

In principle, application development tools applied to client/server development could go a long way toward masking the combinations of technical options which must be selected.

- There are, for example, over 400 combinations of major operating systems, DBMSs and GUIs that target the client/server environment. No application developer can afford to support even a small fraction of these.
- However, the current tools only partially “encapsulate” these choices, as shown in Exhibit II-6. This is because most current tool developers are small companies; they have the same resource problems as other developers.

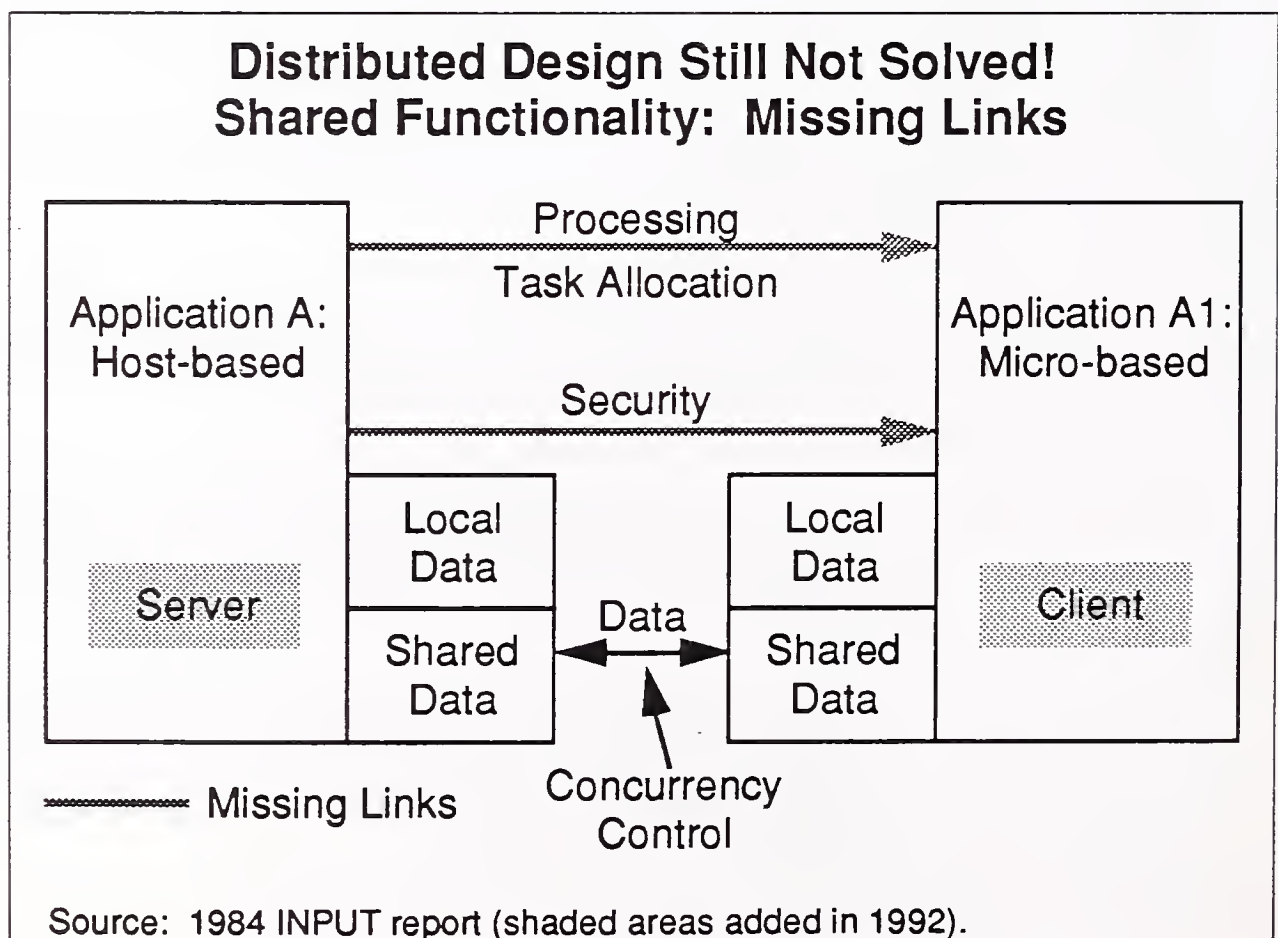
- Even when more complete tools are available, they will have been forced to make assumptions about which combinations of operating systems, DBMSs and GUIs will “win.” If the tool developer makes the wrong choices, the developer could be out of business.

EXHIBIT II-6



A larger and longer term problem is that some of the major conceptual problems facing client/server-distributed applications development are still unsolved. As Exhibit II-7 shows, this has been an unresolved issue since the mid-1980s.

EXHIBIT II-7



Consequently, INPUT does not foresee any CASE breakthroughs in client/server development. Instead, INPUT sees incremental improvements through such actions as:

- Wider use of object-oriented development
- Application of real-time development concepts to the client/server environment

F

Recommendations

CASE should be viewed as a “silver bullet” that has not yet hit the target. INPUT does not expect this to happen in the next five years.

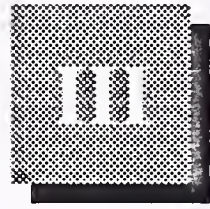
Instead, INPUT believes that users and vendors would be better advised to “enrich” products and services with CASE concepts, techniques and products.

- The extent to which these products and services will be used or welcomed will depend on whether the developing organization has a strong or weak central IS department (see Exhibit II-8).
- Users should look for assistance from outside services providers. Many of the combined business and technical issues are too new or are changing too quickly for most organizations to have built up a usable store of knowledge.

EXHIBIT II-8

“CASE-Enriched” Products and Services

“CASE-Enriched” Product/Service	Strength of Need In:	
	Strong IS Department	Strong User Department
Client/Server Planning	High	Medium
Requirements Analysis	Medium	High
Software Product Evaluation	High	High
Supplying Systems Software Products	High	Medium
Supplying Applications Software Products	Medium/High	Very High
Software Product Installation & Support	Medium/High	High
Application Implementation	Medium	High
Systems Integration	Medium	High



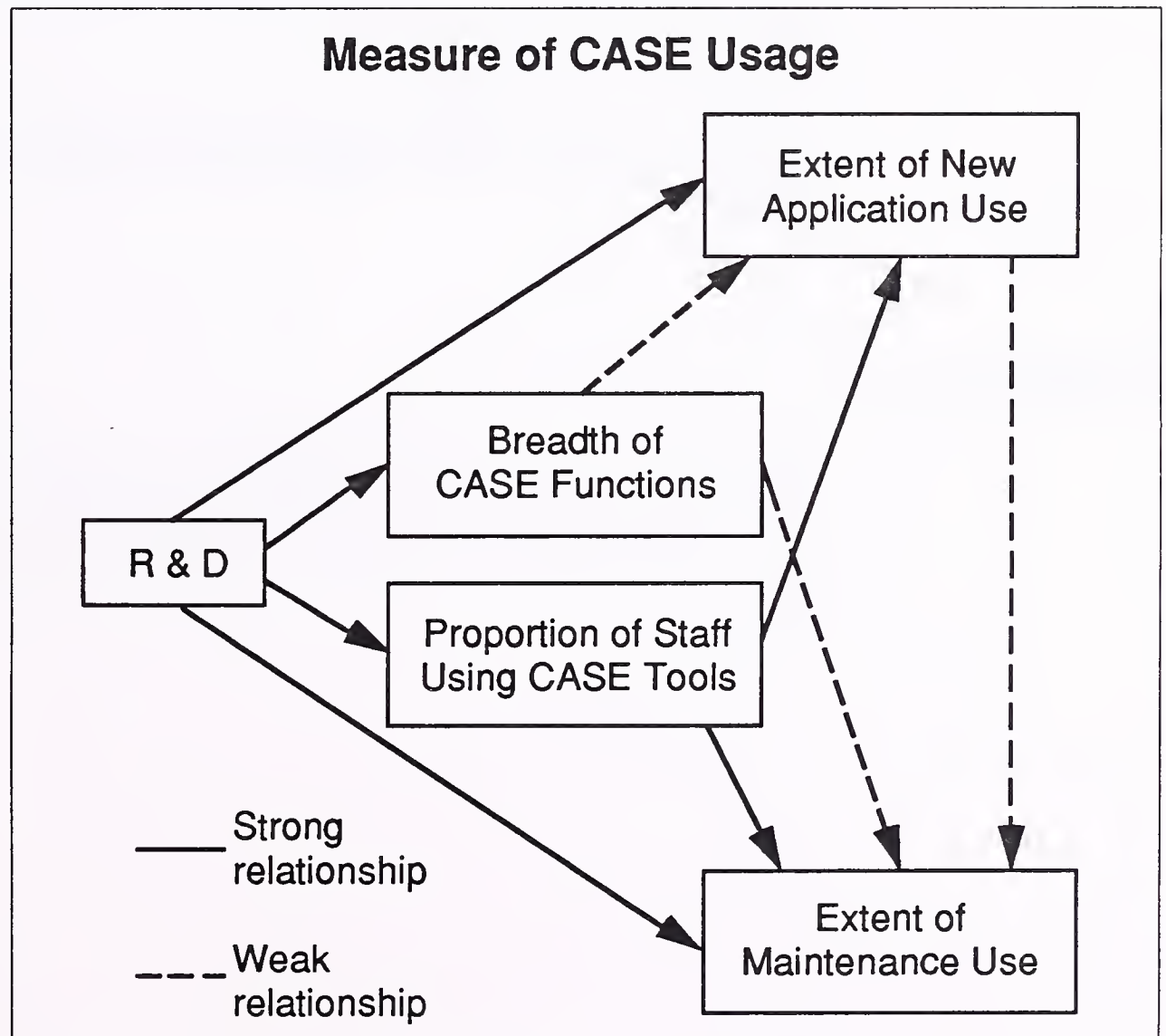
IS CASE Usage: 1992-1995

A

Measures of CASE Usage

There is no single measure for the breadth and depth of CASE use. Exhibit III-1 shows five ways in which the use of CASE can be measured, ranging from R & D to extensive support of new or maintenance applications.

EXHIBIT III-1



INPUT interviewed 54 IS departments that are users of CASE products. These interviews were divided between users of two major sets of CASE products:

- Vendor "A" provides an integrated product that is largely focused on a single hardware platform.
- Vendor "B" provides less integrated products that function on a wider variety of hardware platforms.
- Both firms' products allow for the use of some products from third parties, although third-party use is currently more common among Vendor "B" customers.
- Because these two products and, to some extent, their customers are quite different, data was analyzed in terms of these two groups to see to what extent current and future CASE use was influenced by the type of product selected.

The analysis focused on IS departments because most CASE products are sold as highly technical items to the technical staffs of IS departments. The implications of this situation will be addressed in the next chapter.

Although there are differences in the usage levels of the two vendors' products, INPUT noted many commonalities in usage patterns.

B

R&D Phase Use

Currently, over half the customers in both sets consider themselves at least partly in the R & D phase (see Exhibits III-2 and III-3). Most of the firms interviewed are partly out of this phase, since they are also actively using CASE products.

EXHIBIT III-2

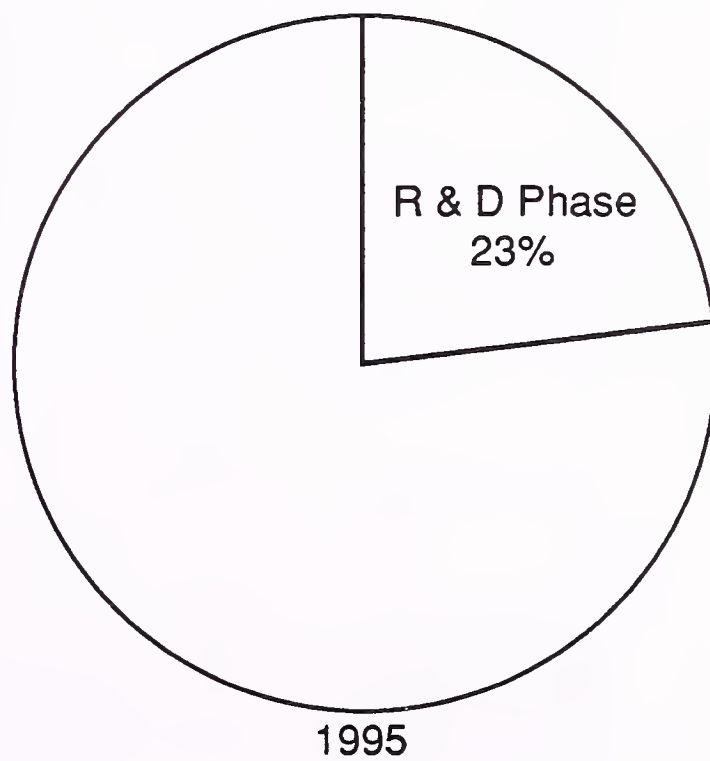
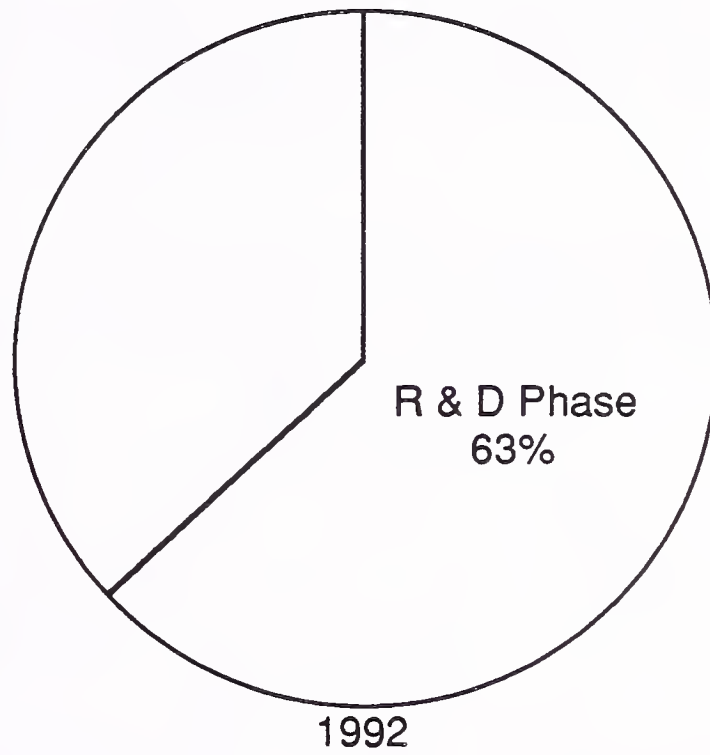
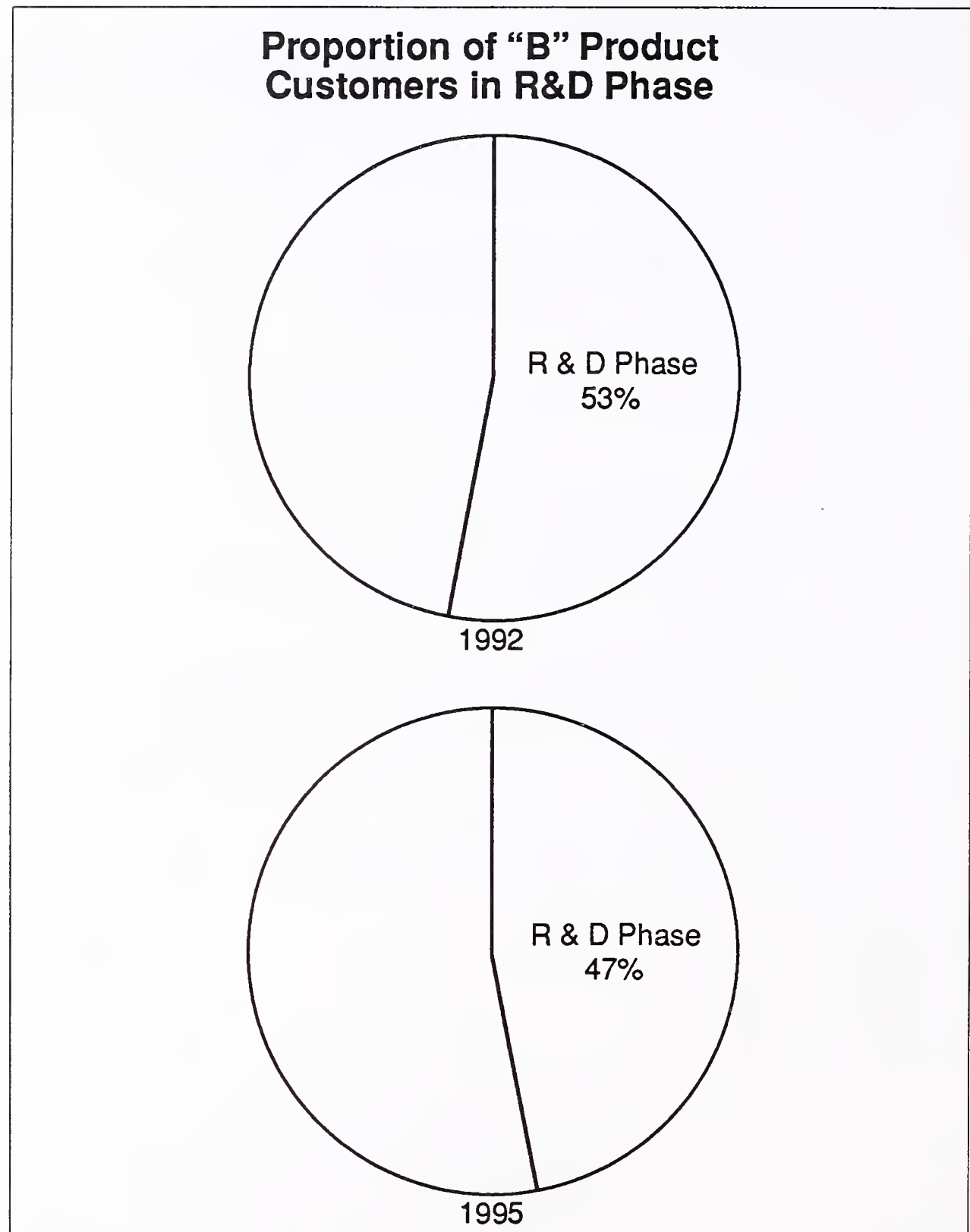
**Proportion of "A" Product
Customers in R&D Phase**

EXHIBIT III-3



Even in three years' time, many of these firms see themselves still being in the R&D phase; for vendor "B," almost half of its customers see themselves in this position.

- This difference appears to be due to the lower degree of integration in product "B." Customers see themselves having to continue to explore their options for a longer period of time.
- Product "A" customers, on the other hand, have in essence already "signed on" and their perceived options are more limited.

C

Variety of CASE Functions Used

A major test of the breadth of CASE use is whether both front- and back-end CASE functions are in use. Exhibits III-4 and III-5 show that two-thirds of respondents are already using a fairly complete set of CASE functions.

EXHIBIT III-4

**“A” Product Customers Use of
Front- and Back-End CASE Functions:
1992 and 1995**

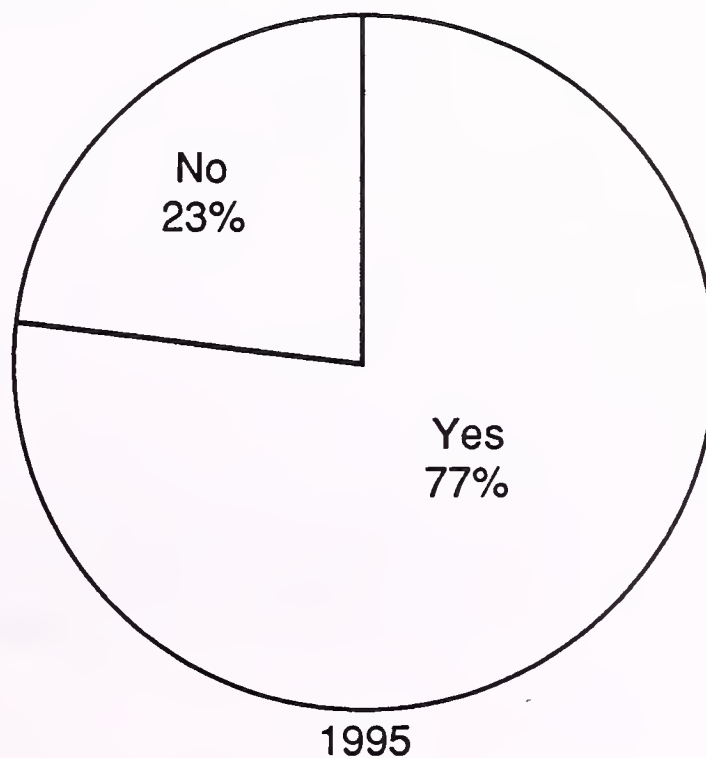
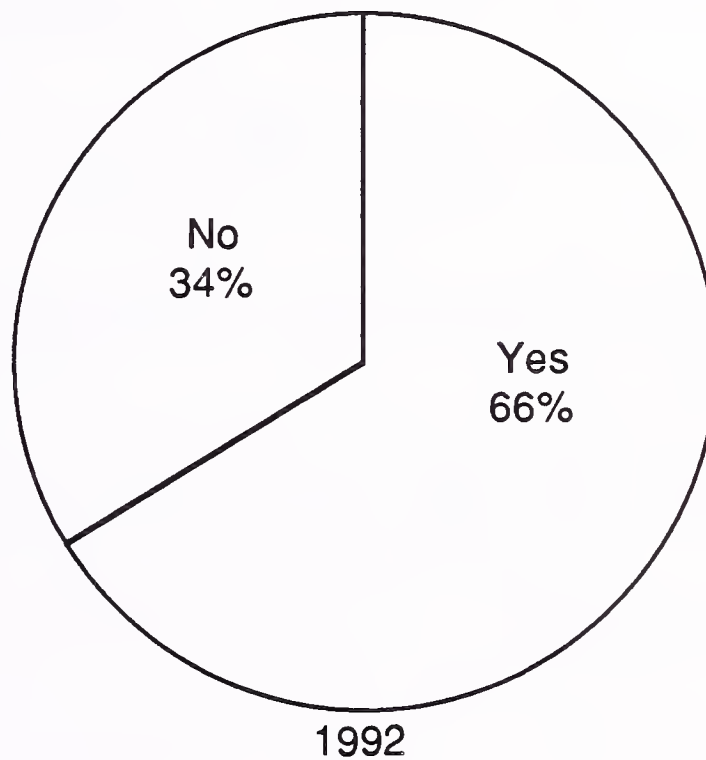
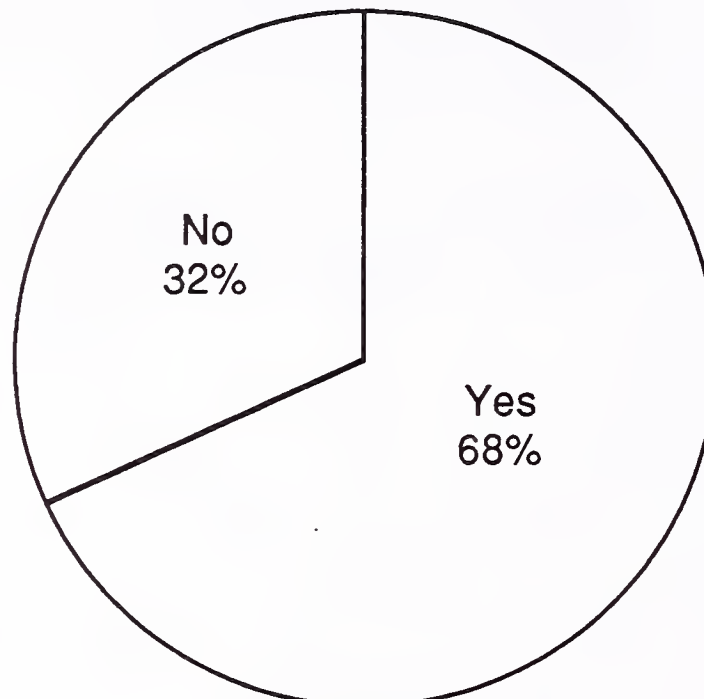
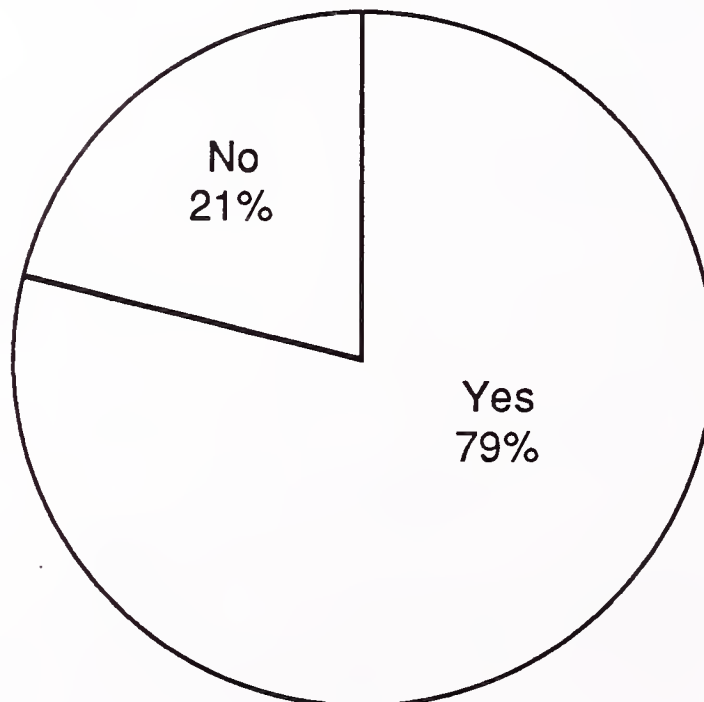


EXHIBIT III-5

**“B” Product Customers Use of
Front- and Back-End CASE Functions:
1992 and 1995**



1992



1995

- These figures could somewhat overstate the breadth of use because not all people or projects are necessarily using the full set of functions available. However, the interviews indicated that this was not a significant factor.

- The interviews did not determine in all instances whether this front- and back-end use was with the products of the *same* vendor; however, in context, the vast majority of firms interviewed were using front- and back-end tools supplied by a single vendor.

Also of interest is the relatively low growth foreseen in the variety of functions used. This fact may partly explain the fall-off in customer orders—at least measured against the rosy expectations of 1990—for CASE products in 1991 and 1992 in the U.S.

D

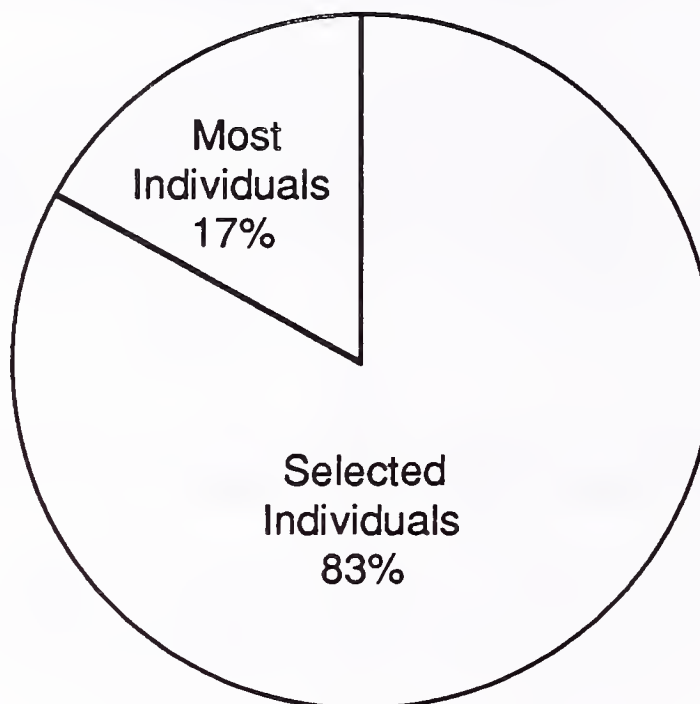
Proportion of Staff Using CASE Products

Perhaps even more important than the variety of product use is the amount of use among applications developers.

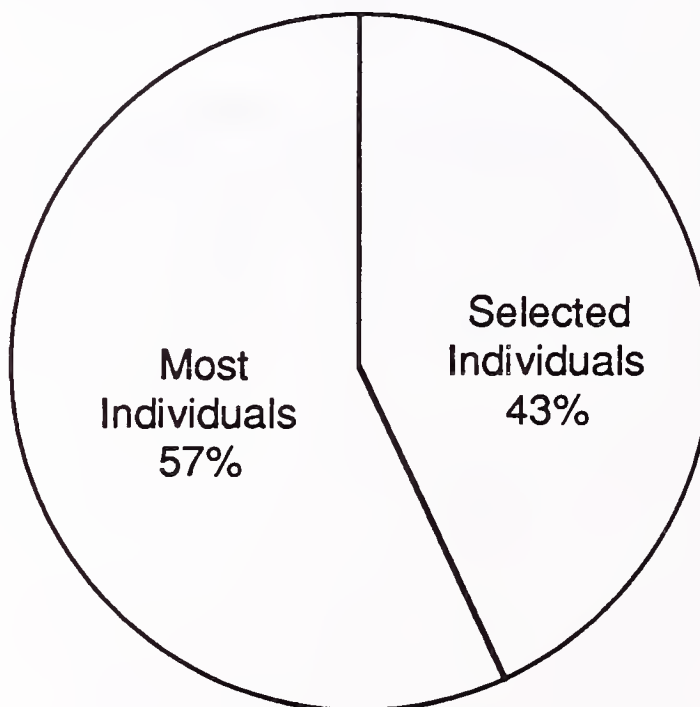
- Among the users of vendor “A’s” product, in only one out of five firms are most individuals using the CASE tool, as shown in Exhibit III-6.
- About the same proportion of firms using product “B” are high-intensity users (see Exhibit III-7). Note, however, that one-fifth of these firms admit to having shelfware.

By 1995, about one-half of the firms see most individuals using CASE tools.

EXHIBIT III-6

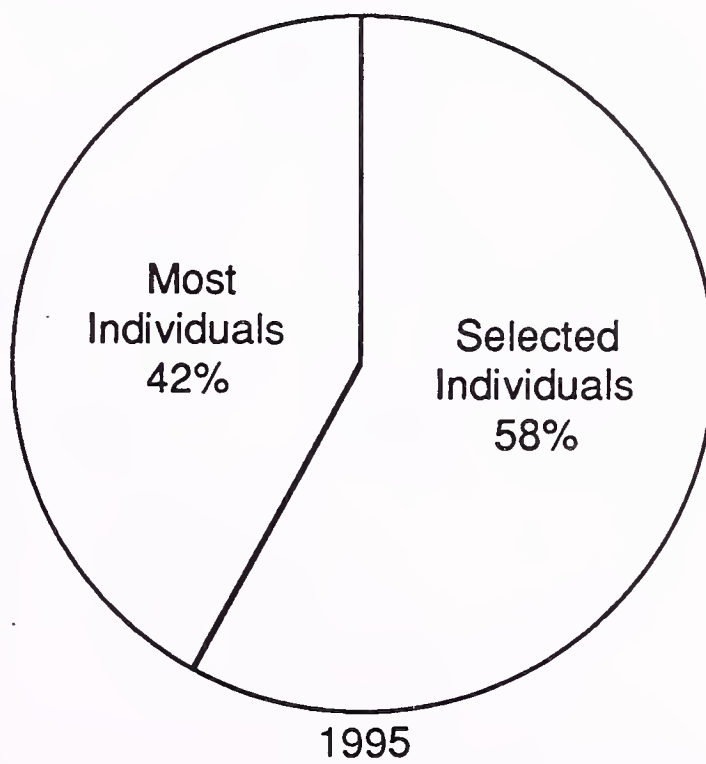
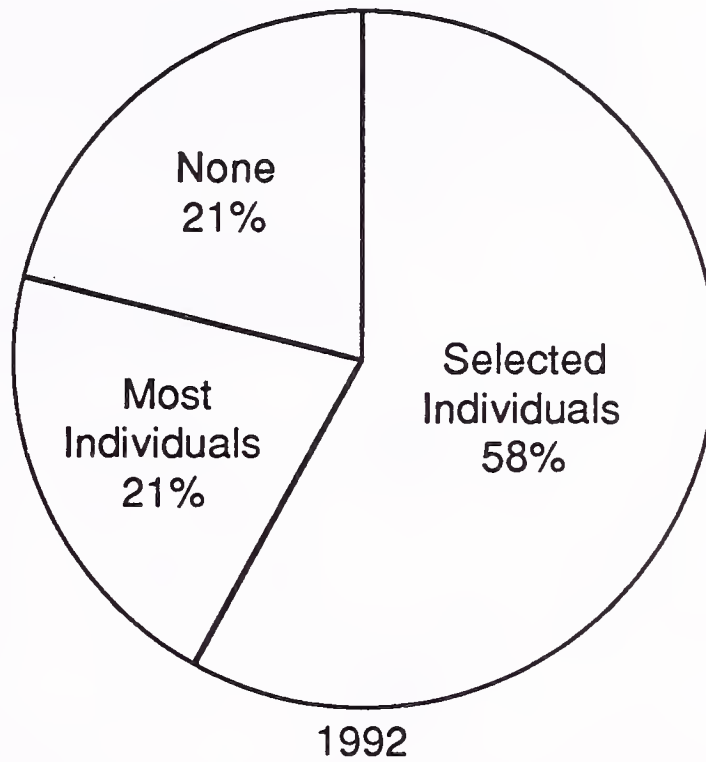
**Proportion of Staff Using
"A" Products: 1992 and 1995**

1992



1995

EXHIBIT III-7

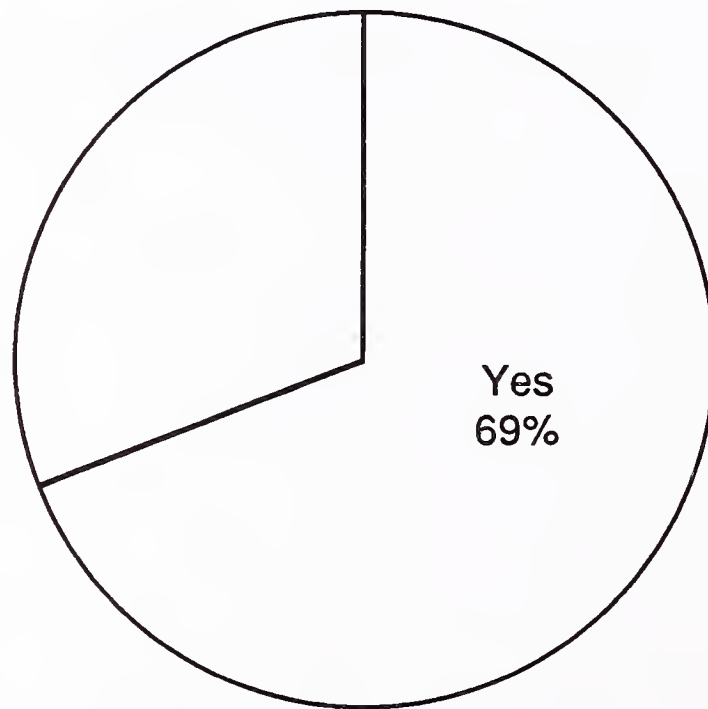
**Proportion of Staff Using
"B" Products: 1992 and 1995**

E

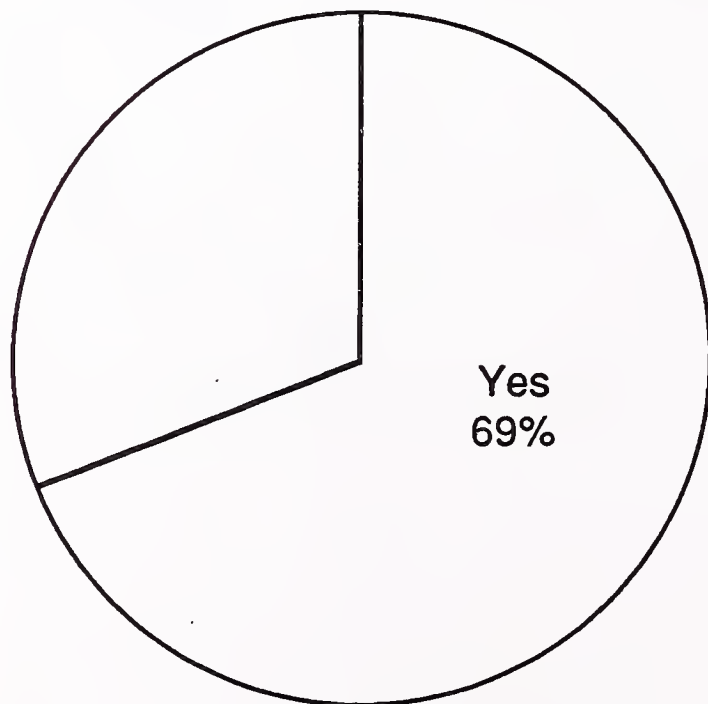
CASE Use in New Applications Development

A very striking finding is that the great majority of firms interviewed say that CASE products are already being used for most new projects (see Exhibits III-8 and III-9). This data should be accepted with certain reservations, which follow below.

EXHIBIT III-8

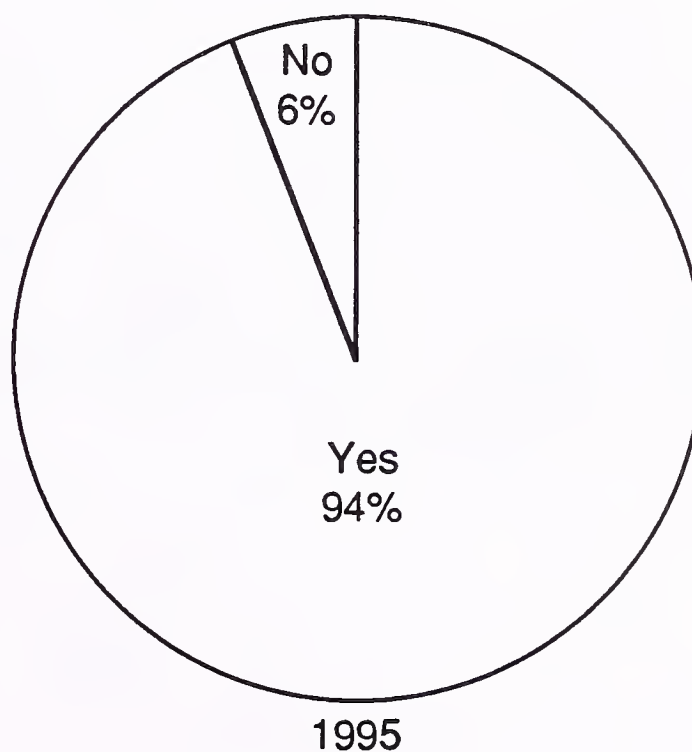
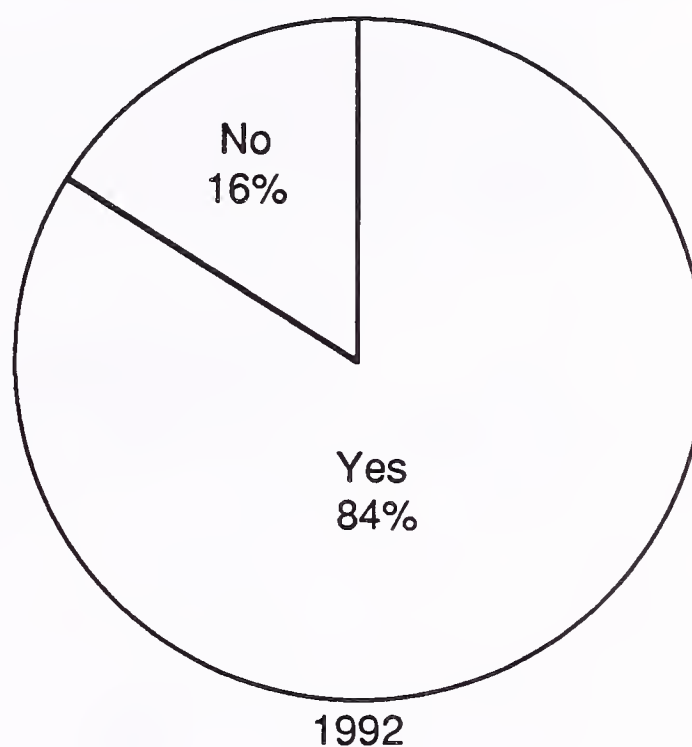
**Extent of Use of "A" Products in
Most New Projects: 1992 and 1995**

1992



1995

EXHIBIT III-9

**Extent of Use of "B" Products in
Most New Projects: 1992 and 1995**

- In many organizations, new development only accounts for 10-20% of overall development resources. In that situation, "most" new projects may still be a relatively small number.
- All projects are not of equal size. Information obtained elsewhere in the interviews indicates that projects in which CASE is being used tend to be smaller projects, consuming fewer resources.
- Finally, the IS department, which is the most likely to use CASE technology, is controlling—or even involved in—fewer and fewer applications projects. (This point is developed extensively in the next chapter.)

F

Use of CASE in Maintenance

About 30% of respondents say that they are using CASE tools for maintenance (see Exhibits III-10 and III-11). However, these are not the same tools that are being used for the front and back ends of new development. In most instances, these "CASE" tools are little more than improved debugging aids.

EXHIBIT III-10

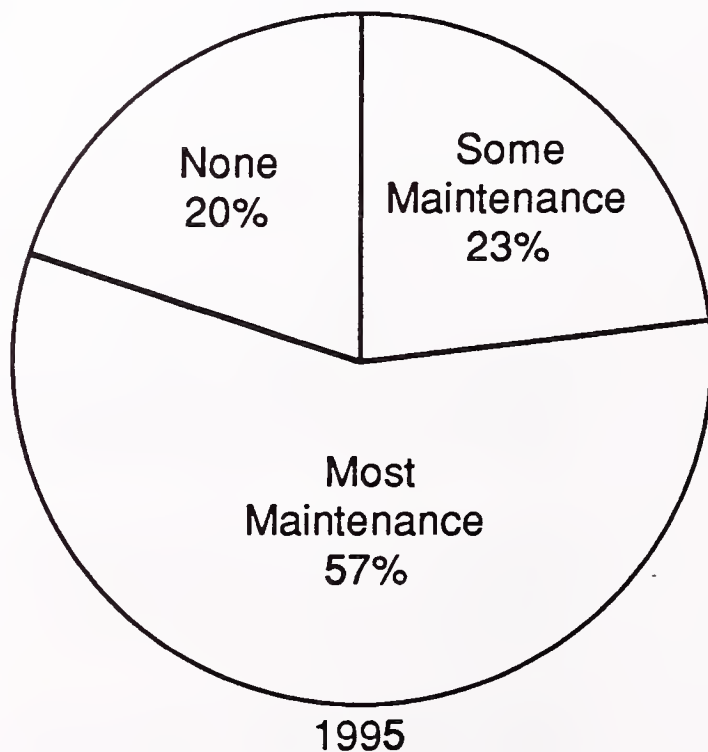
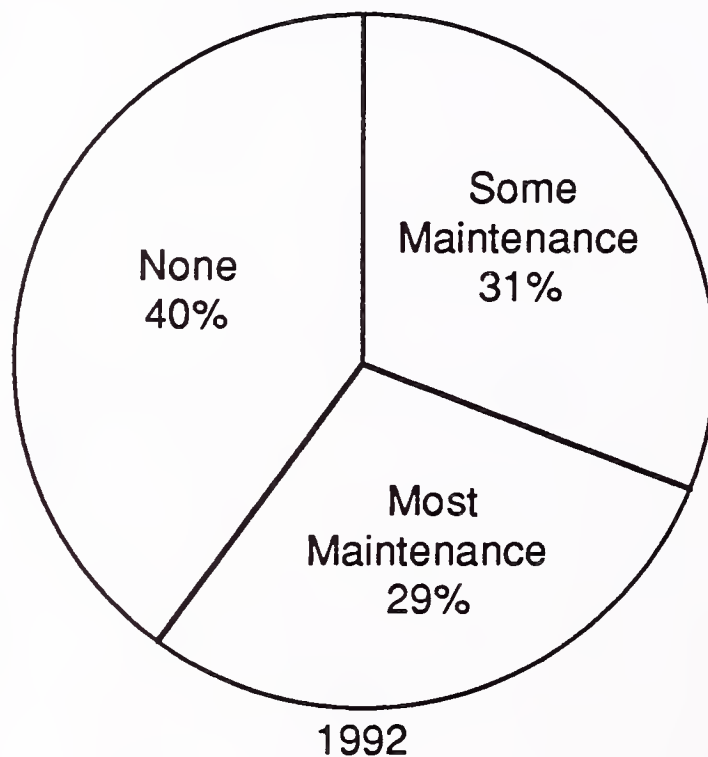
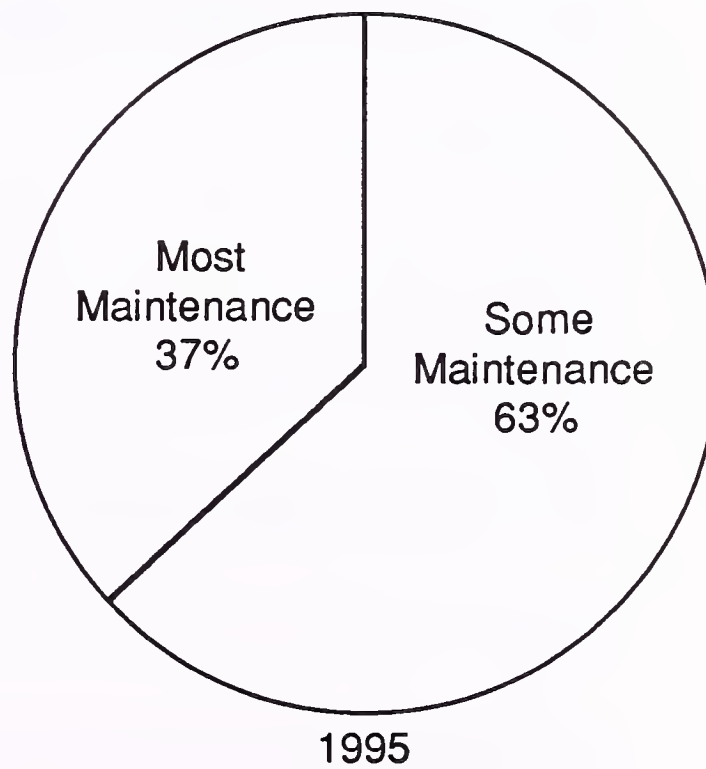
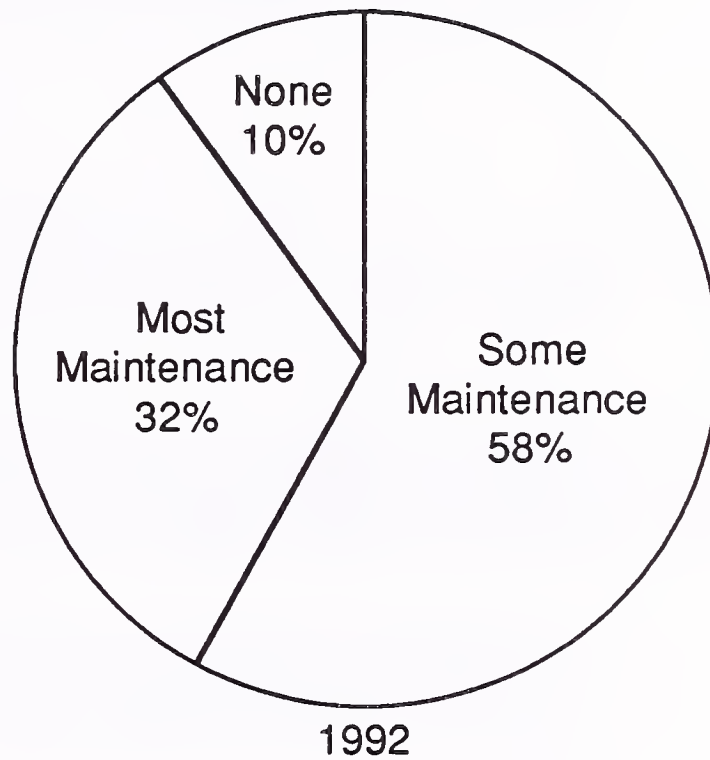
Extent of Use of "A" Products for Maintenance: 1992 and 1995

EXHIBIT III-11

**Extent of Use of "B" Products for
Maintenance: 1992 and 1995**

Product "A" users see more movement into using CASE tools in the maintenance process. This may be connected with Vendor "A's" efforts to move more into the maintenance market. There is also considerable movement from using no tools for maintenance to using at least some form of tools.

G

Conclusions

INPUT raises a warning flag at the high rate of CASE R&D versus the use of CASE in most new projects.

- It is theoretically possible that R&D efforts are taking place in areas that have nothing to do with current use of CASE. However, INPUT's observations are consistent with the interpretation that many companies have committed to CASE without thoroughly understanding it.
- CASE failures become much more understandable when viewed against the need for ongoing R&D. That is, the R&D is continuing *because* a firm has realized that its CASE commitment may have been premature.

Another important finding is that the *net* use of CASE is relatively low, once the proper allowance is made for:

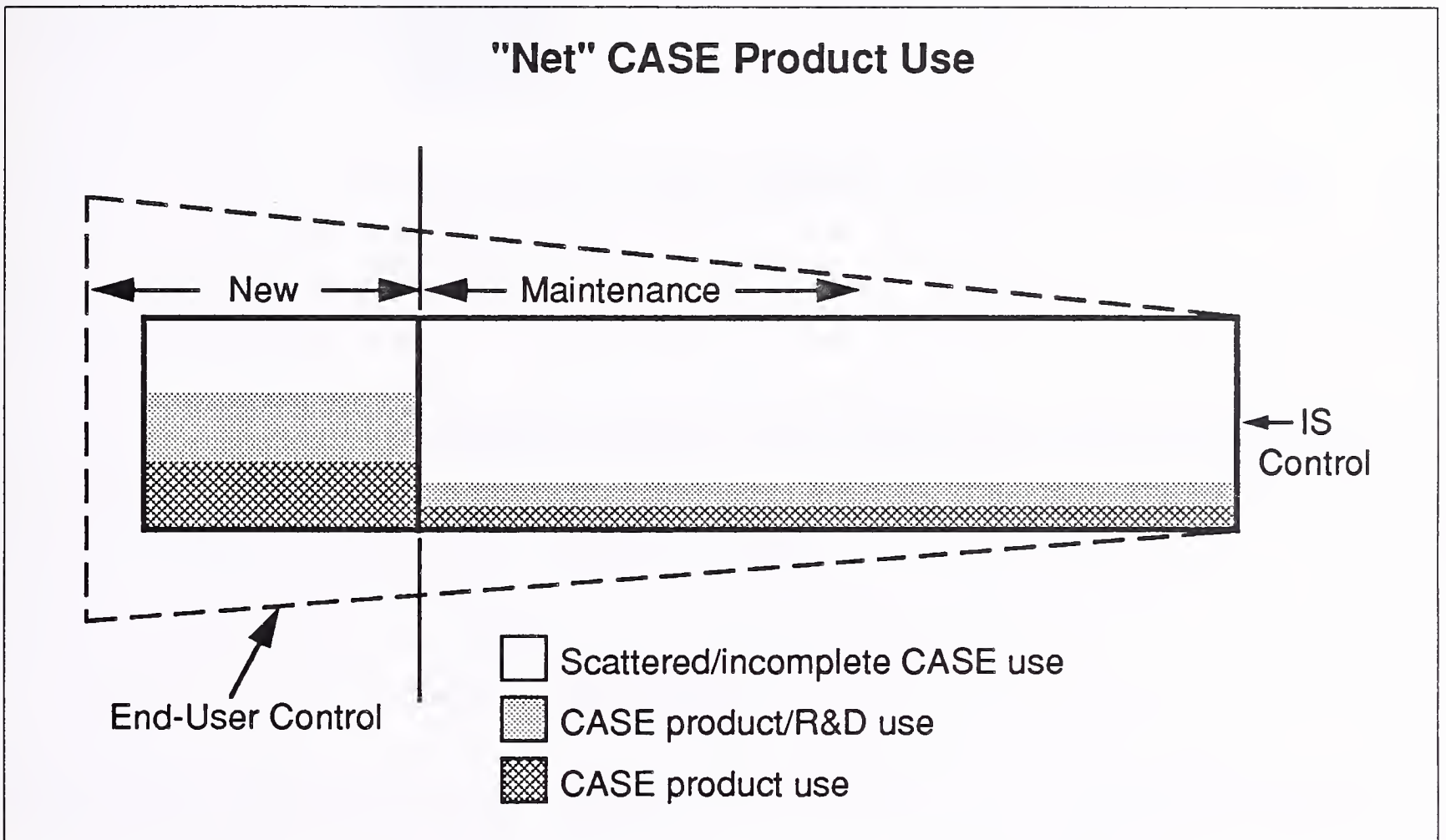
- The relatively small amount of new development in most organizations
- The varying effectiveness of using CASE even in new development
- The amount of new development that occurs outside of the traditional IS organization. This last point is addressed in Chapter IV.

Exhibit III-12 shows these relationships in schematic form and shows the "net" amount of CASE penetration.

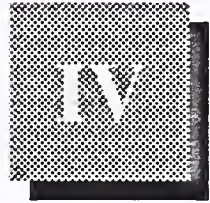
- The lighter areas show the areas with lower amounts of current penetration.
- In principle, these areas could be penetrated further. However, respondents' 1995 plans show relatively small amounts of growth in the key areas of CASE functions used, new project use and, to a large degree, maintenance use.
- This data helps explain the plateau in CASE use and CASE product purchases in the U.S.

What are the chances of regaining higher levels of CASE growth? The next chapter examines the key issues.

EXHIBIT III-12



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Downsizing and CASE: Driving Forces

This chapter reviews the major forces that are changing the demand side for CASE products and services, specifically:

- Trends in CASE capabilities
- Increased role of user departments
- Organizational changes

A

CASE Capabilities and Market Trends

Most CASE methodologies and tools are oriented toward what INPUT terms “host-led” platforms and development (either mainframes or traditional minicomputers). There is still considerable progress to be made, especially in applying software engineering to a maintenance environment, but CASE capabilities in the host-led environment are basically adequate.

The picture is quite different for newer platforms.

- PC/workstation environments can choose from a variety of tools for new development; however, offerings are not complete for PCs/workstations as *target* operating environments.
- For client/server environments, there are relatively few software engineering products, although there are increasing numbers of development tools. These technical issues are addressed in more depth in the next chapter.
- Exhibit IV-1 summarizes the situation. To the extent that target platforms are not in the “host-led” category, CASE products will be less attractive and use will be lower overall.

EXHIBIT IV-1

CASE Capabilities for New Development and Maintenance by Platform

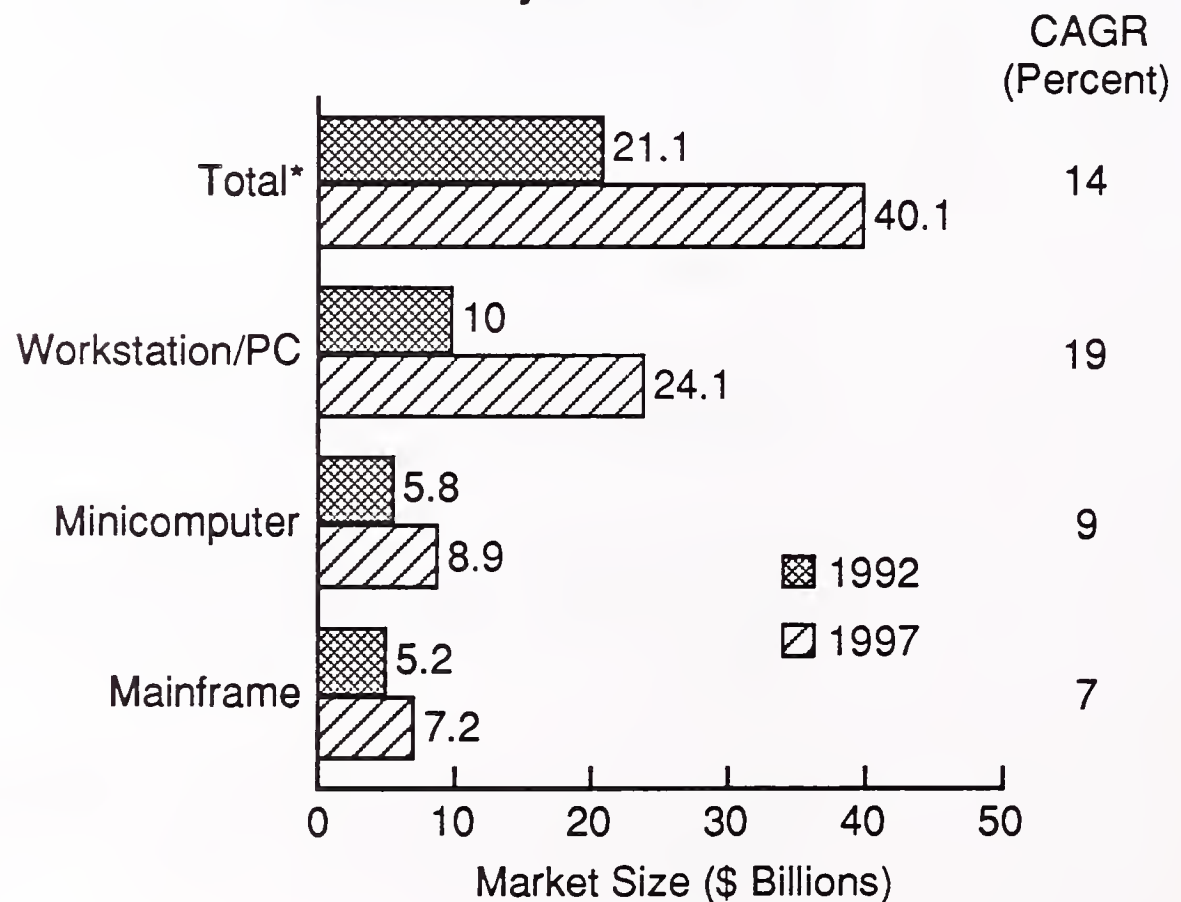
Target Platform	CASE Capability	
	New Development	Maintenance
Host-Led (mainframe/minicomputer)	Medium	Medium/Low
Client/Server	Low	Very Low
PC/Workstation (standalone)	Medium/Low	Very Low

Source: INPUT Assessment

The trend for applications software products in general is away from mainframes and minicomputers to workstations/PCs, as shown in Exhibit IV-2. INPUT classifies most client/server activity in the workstation/PC category.

EXHIBIT IV-2

Applications Software Products Market by Platform Size



B**Applications Decision-Making Role of User Departments**

Most IS departments are seeing their applications decision making roles being assumed by user departments. This is especially true for large organizations, which have been most active in using CASE concepts and tools (see Exhibit IV-3). The great majority of IS departments expect this trend to continue (see Exhibit IV-4).

EXHIBIT IV-3

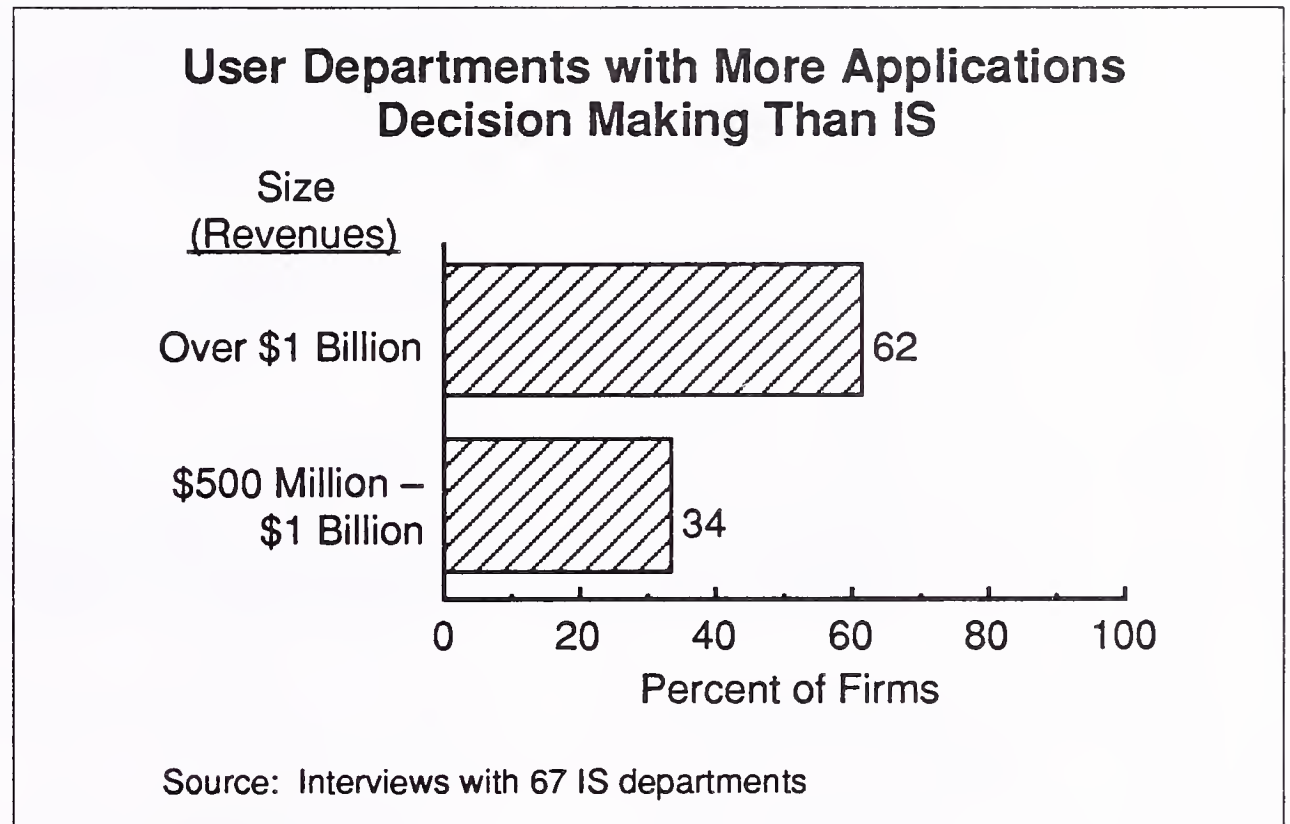
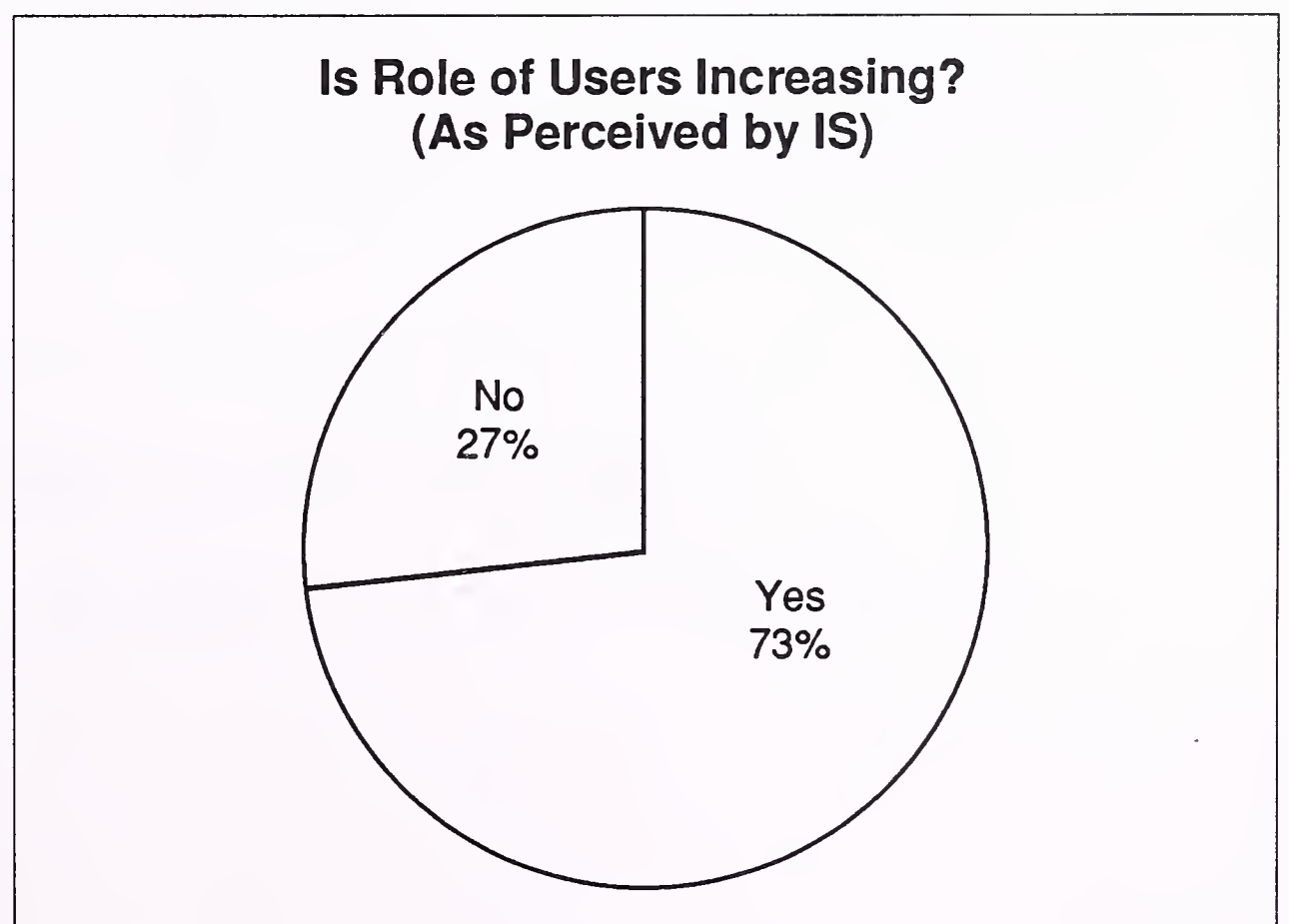


EXHIBIT IV-4



There are several operational implications arising from these trends:

- Individual operating units are more likely to reject comprehensive corporatewide systems, even if, in the abstract, a corporate system would make the most sense (e.g., a combined financial/marketing/production/logistics system).
- Such large systems have a greater chance of absolute or relative failure and generally take longer to install.
- Equally important, individual departments lose control over the development process. The control issue is so important that many departments will knowingly trade suboptimal systems in favor of systems that they can both control *and* implement quickly.
- This last point is especially important in a user-controlled environment: the use of packaged applications and/or systems integrators becomes compelling and attractive.

Exhibit IV-5 summarizes these points.

However, it is large, complex systems to which CASE has heretofore offered the most long-term opportunities for application development.

EXHIBIT IV-5

Advantages and Disadvantages of Different Application Sources

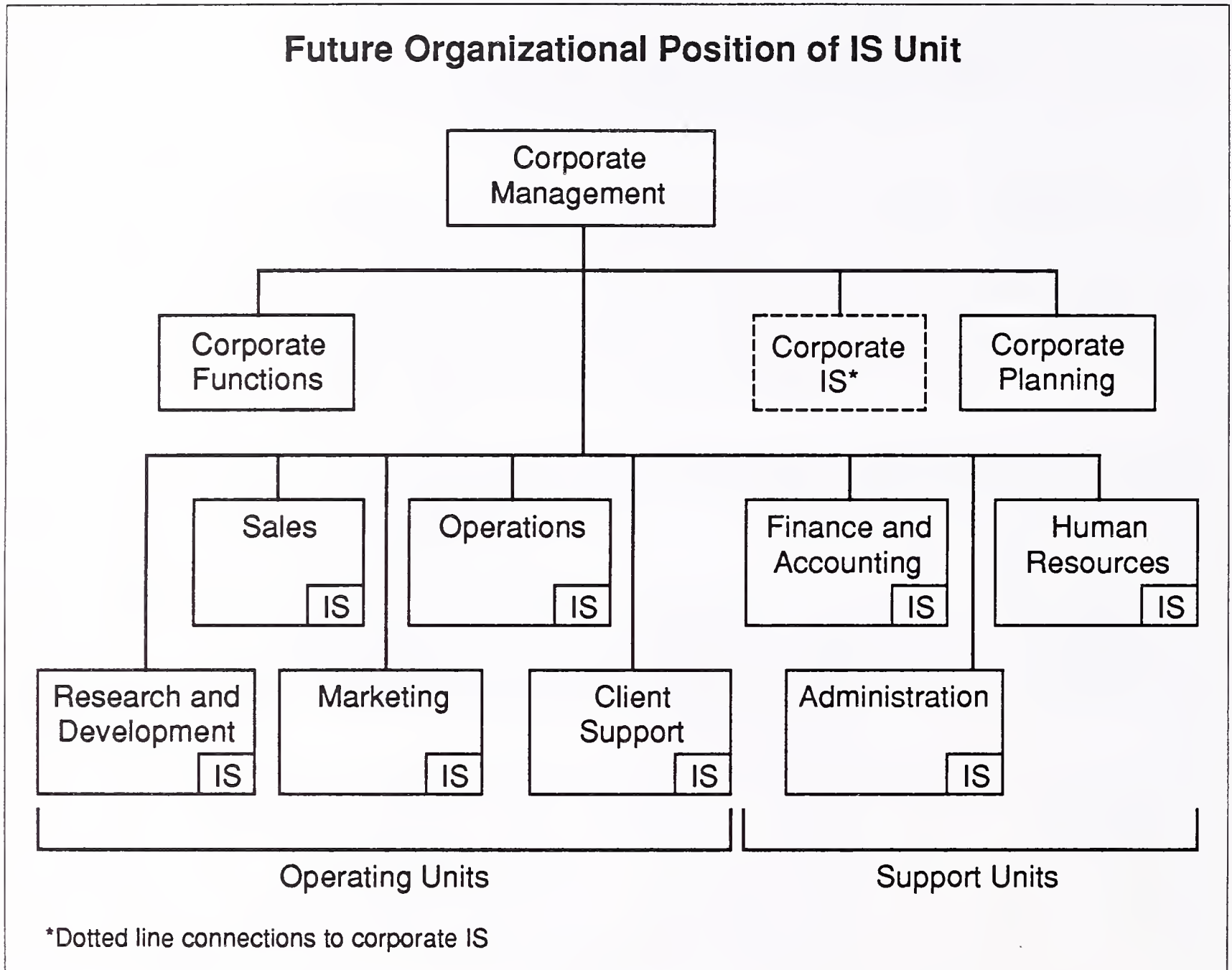
Application Source	Advantages	Disadvantages
Corporatewide Custom Development	<ul style="list-style-type: none"> • Optimize corporate objectives • Seamless integration 	<ul style="list-style-type: none"> • Significant technical risk • Individual unit objectives compromised • Loss of control by individual units • Longer elapsed time
In-house custom development: departmental	<ul style="list-style-type: none"> • Exact fit • Control 	<ul style="list-style-type: none"> • Some technical risk business needs • Longer elapsed time
Packaged software	<ul style="list-style-type: none"> • Faster installation • Reduced technical risk, especially for new technology 	<ul style="list-style-type: none"> • Occasional tailoring • Ongoing modification may be more difficult
System integrator	<ul style="list-style-type: none"> • Reduced technical risk, especially for new technology • Can incorporate broad knowledge into application specifications 	<ul style="list-style-type: none"> • In some situations, gives up control and knowledge • Potential "leakage" of proprietary information (business and technical)

C

Organizational Changes Affecting the Use of CASE

The IS organization of the future is likely to resemble that shown in Exhibit IV-6 in many cases.

EXHIBIT IV-6



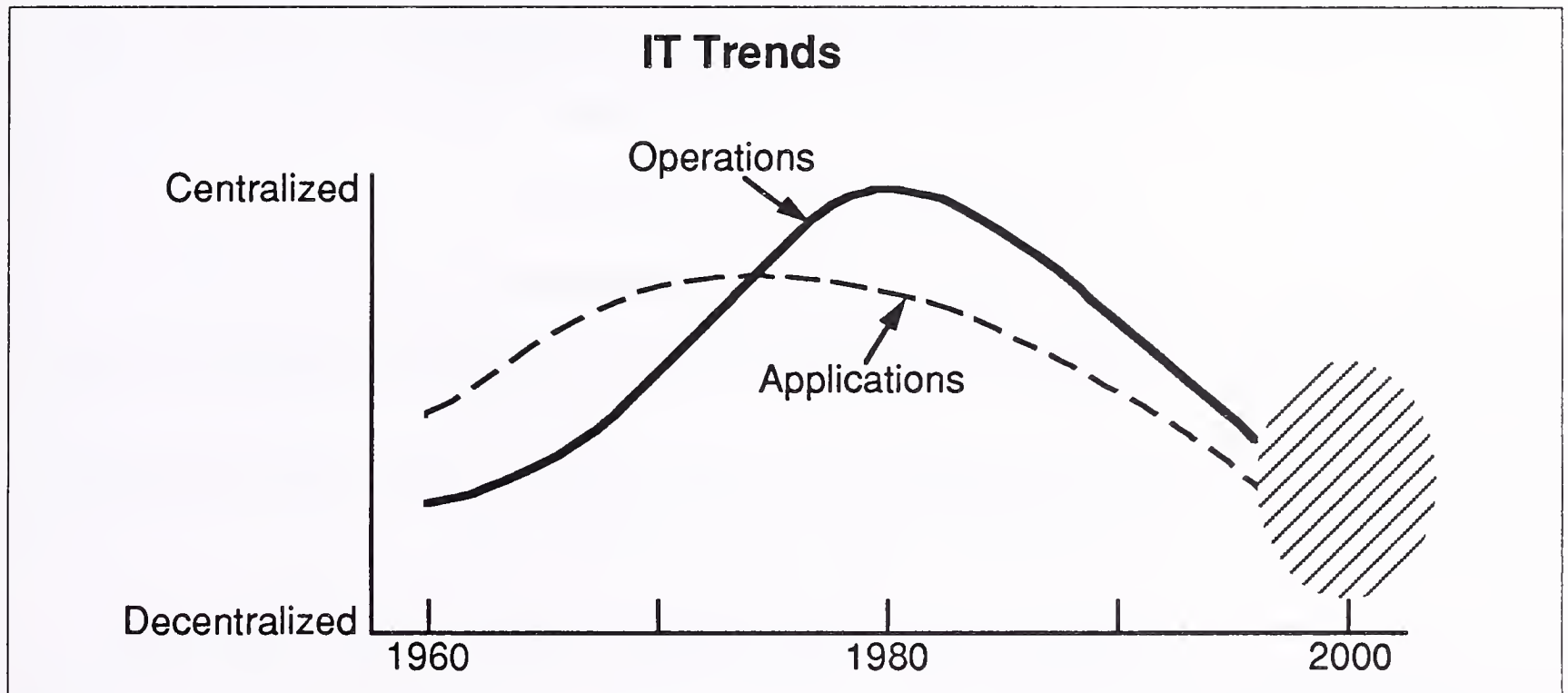
- The “Corporate IS” box often may not even exist.
- Where there is a corporate IS function, it will be advisory and coordinative. Corporate IS in this situation will not set budgets or develop corporate IS plans that have any certainty of execution.

This situation may have benefits for overall systems development and execution. The operating units will be energized and better able to tie systems to business needs.

However, many of these unit IS groups will be too small to support technology initiatives in general and CASE initiatives specifically. Even where the units have the capabilities to support technology initiatives, their priorities will often be directed more toward business and implementation. They will also be led to software product and systems integration solutions.

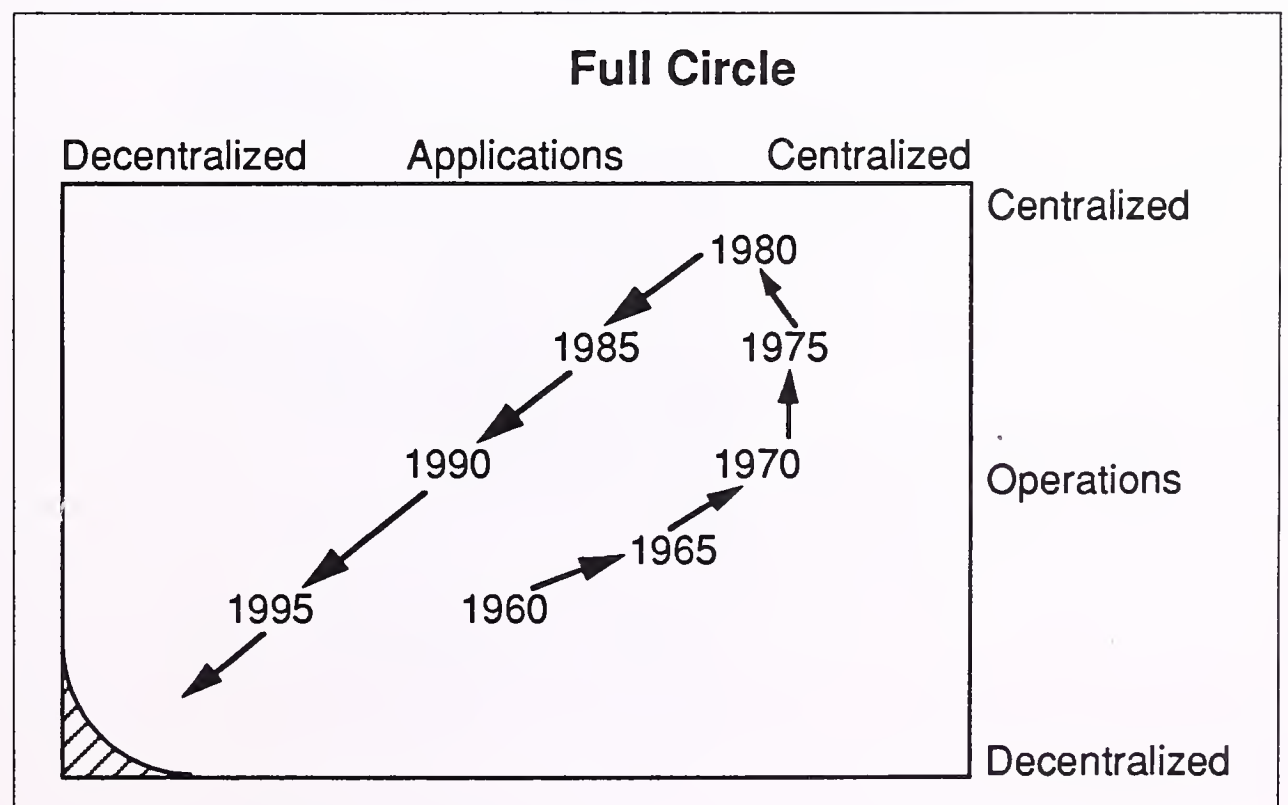
Applications and operations have become more decentralized since 1980. INPUT expects these trends to continue for the foreseeable future (see Exhibit IV-7).

EXHIBIT IV-7



- The centralization of applications and purchasing that reached its high point in the late 1970s and early 1980s was, in hindsight, an aberration (see Exhibit IV-8).
- However, the development of CASE concepts and tools in the mid-1980s was rooted in a construct that was already changing.

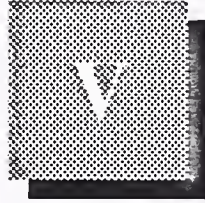
EXHIBIT IV-8



D**Summary**

The underlying changes occurring in the applications development environment do not appear to be conducive to breakthroughs in CASE use.

- CASE is most developed and has the most to offer for “traditional” host-led platforms. However, long-term trends are undermining the demand for applications built on these platforms.
 - Central IS departments are losing ground.
 - CASE has not proved to be a “silver bullet.”
 - Decentralized IS operations often do not have the critical mass and/or backing to use CASE.
- Decentralized client/server environments on the whole are less friendly toward software engineering.
 - They are much more oriented toward short-term results than longer term CASE investment. Decentralized units are very open to packaged applications or systems integration, for example.
 - Client/server CASE technology has much less to offer currently than CASE concepts and products that are rooted in host-led systems.
- Applications maintenance for host-led applications using CASE concepts and products could be fertile ground for both users and vendors. However, both concepts and products have been slow to develop.



Downsizing and CASE: Technical Issues

Downsizing is serving as an accelerator for applications replacement.

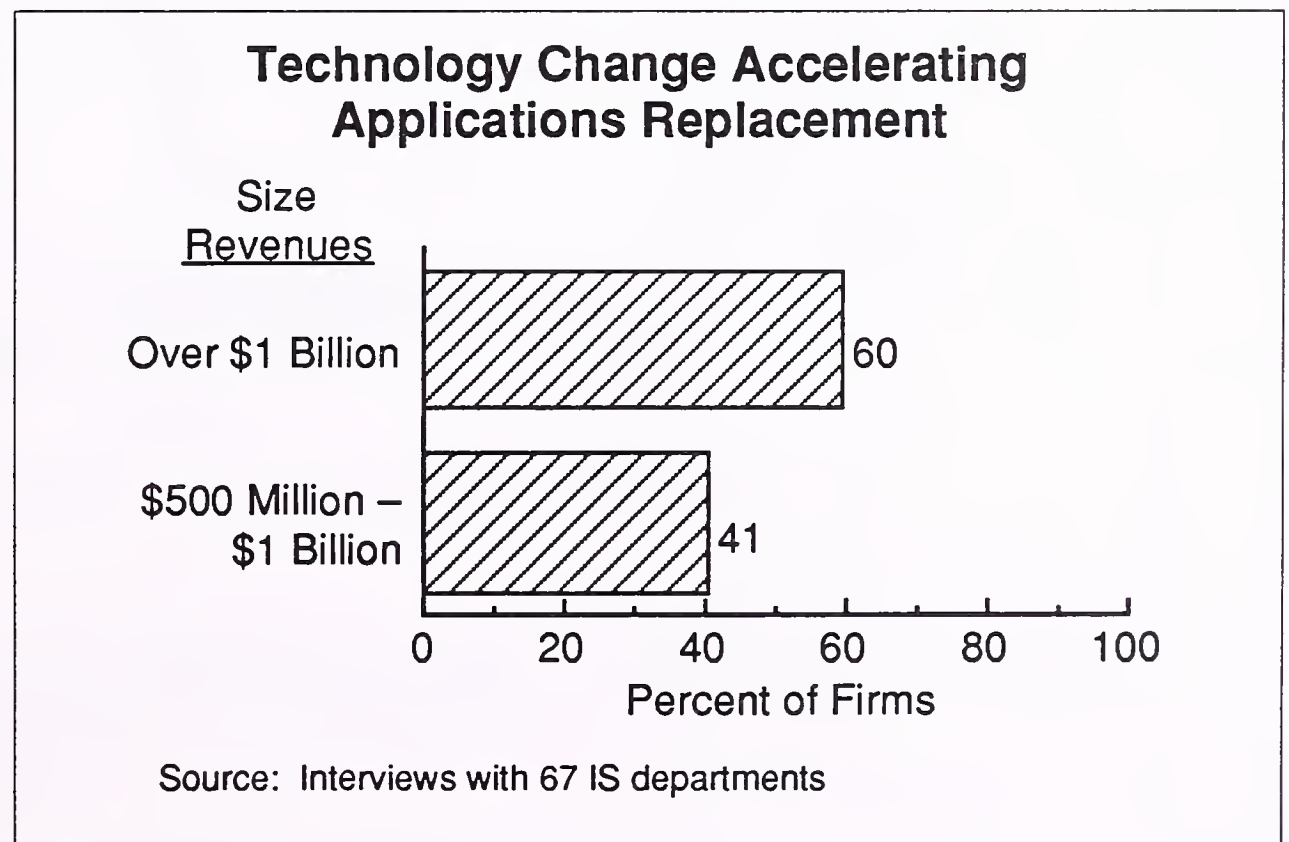
- Chapter IV analyzed the business and organization forces impacting applications.
- This chapter examines the technical aspects of downsizing on applications development.

A

Technical Change

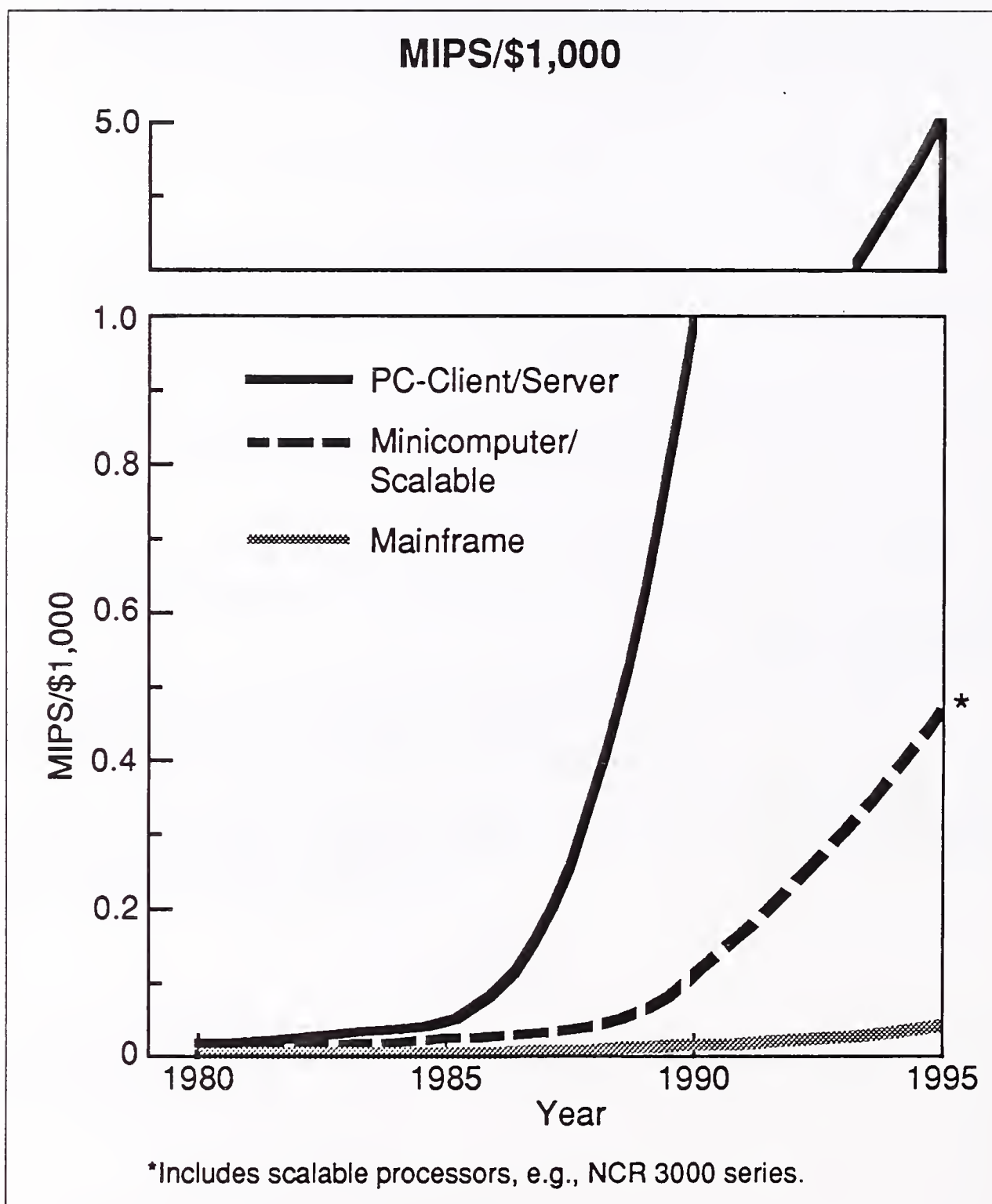
Technical changes change not only the focus of applications development, but also the rate at which it occurs (see Exhibit V-1).

EXHIBIT V-1



- LAN-based systems are expanding at over 20% a year, compared to zero growth in traditional telecommunications environments.
- A related and very strong influence for change is the decrease in cost of raw computing power on the PC or client/server level (see Exhibit V-2).

EXHIBIT V-2

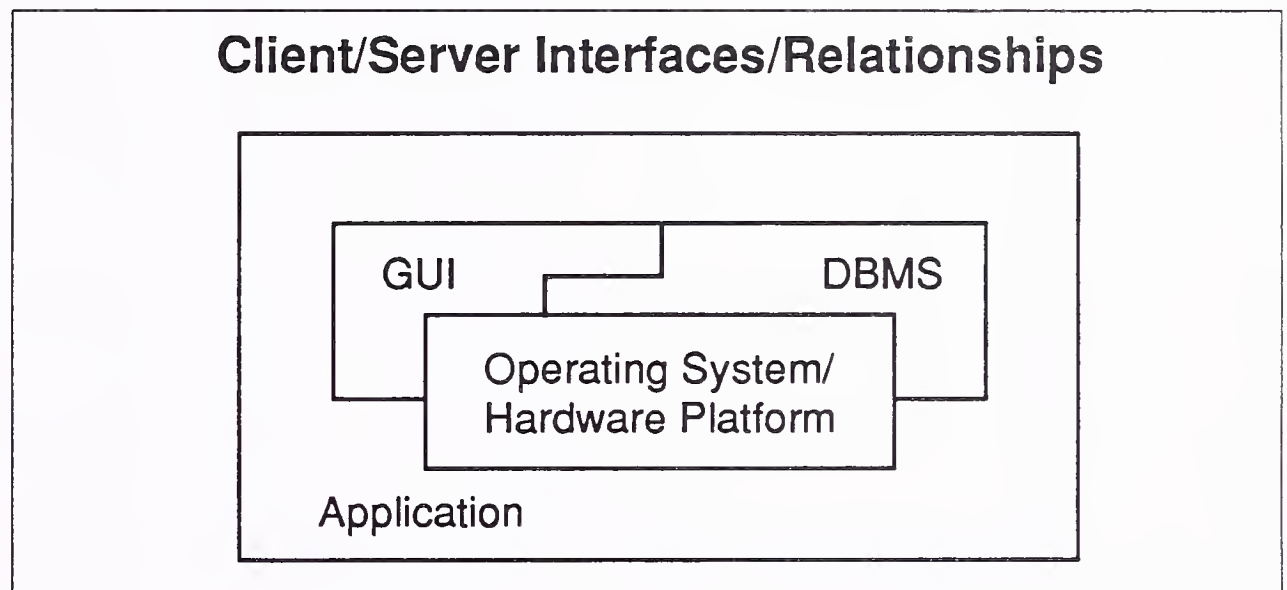


- These new technologies still have teething problems. In many respects, client/server technology and related applications are not as robust as host-led environments. However, these new environments are inherently attractive to the ultimate customer, the end user.

B**The Client/Server Environment**

The key components of client/server environment are shown in Exhibit V-3. The strength and weakness of this "environment" is that there are in reality many overlapping (and incompatible) options.

EXHIBIT V-3



- There are at least half a dozen major alternatives in operating environments. Each of the vendors in Exhibit V-4 sees control of the client/server platform as vital to its future. At present these vendors pay only lip service to cooperation and establishing common standards; this is illustrated by the problems that the Object Management Group has had in obtaining critical industry support.

EXHIBIT V-4

Selected Client/Server Operating Environments

Platform	Vendor
Macintosh	Apple
OS/2	IBM
NT	Microsoft
Windows	Microsoft
Object Management Architecture (OMA)	Object Management Group
"Pink"	Taligent (IBM/Apple)
UNIX	Various

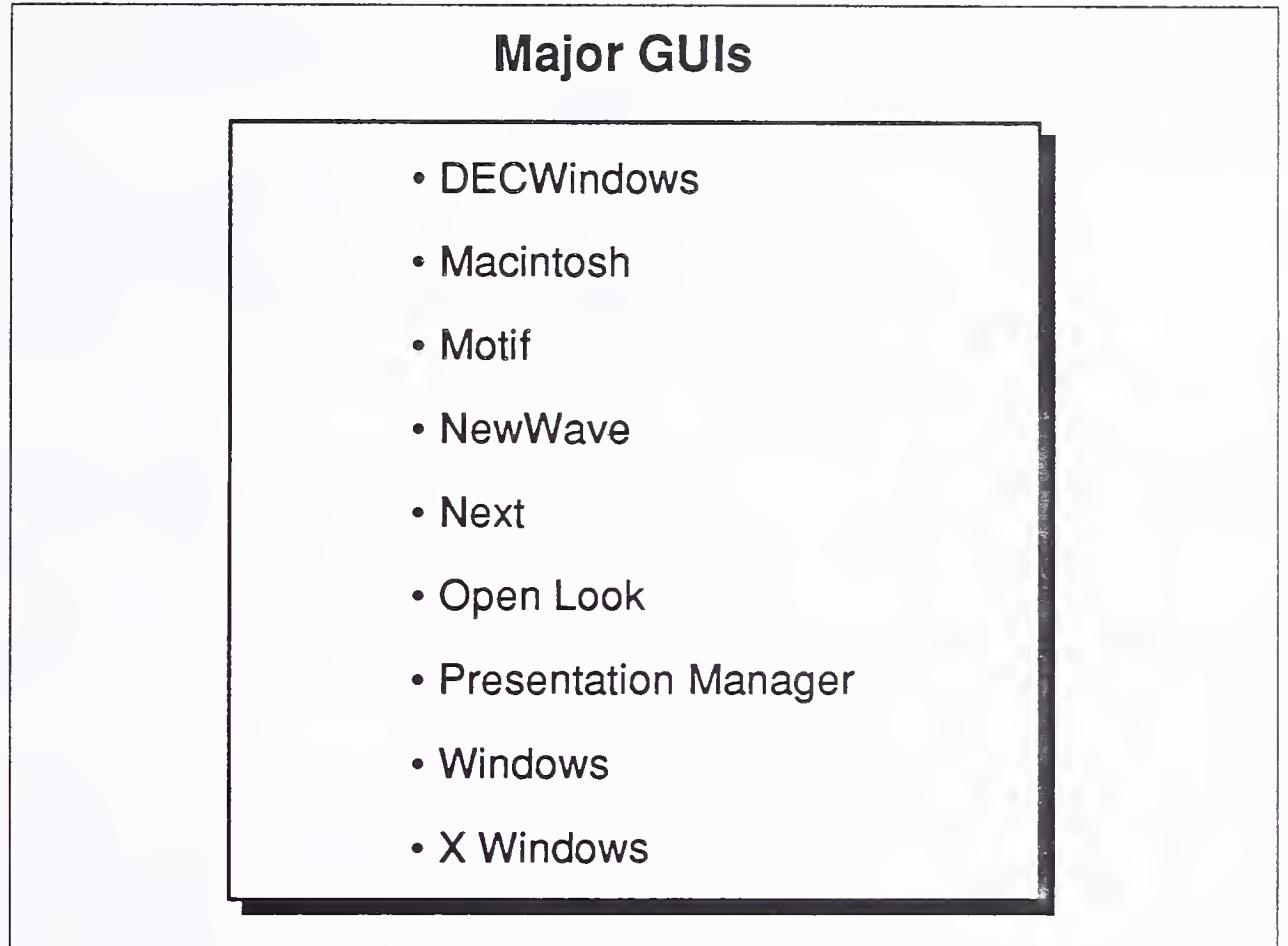
- A similar situation exists in data base servers (Exhibit V-5). These products offer similar functionality and vendors of them see client/server technology as vital to their long-term success.

EXHIBIT V-5

Selected Client/Server Data Base Servers	
Server	Vendor
Ingres	ASK
Rdb	DEC
SQL Server	Gupta
All base	HP
DB2	IBM
Informix	Informix
Oracle	Oracle
Sybase	Sybase

- Exhibit V-6 shows major GUI suppliers. The proprietary platform suppliers have no incentive to unite around a common GUI (even though a GUI may account for nearly half of the coding for a client/server application).

EXHIBIT V-6



Simple mathematics produces over 400 combinations of GUIs, data bases and platforms from those listed in the three preceding exhibits.

- There is little consensus yet on who the “winners” will be for individual components, or what the most effective combinations will be.
- A client/server development strategy becomes, at best, placing trust on a key vendor.

The decentralization trend described in the preceding chapter means that there will often not be a “client/server standard” even in a single corporation (or at least one that is enforceable).

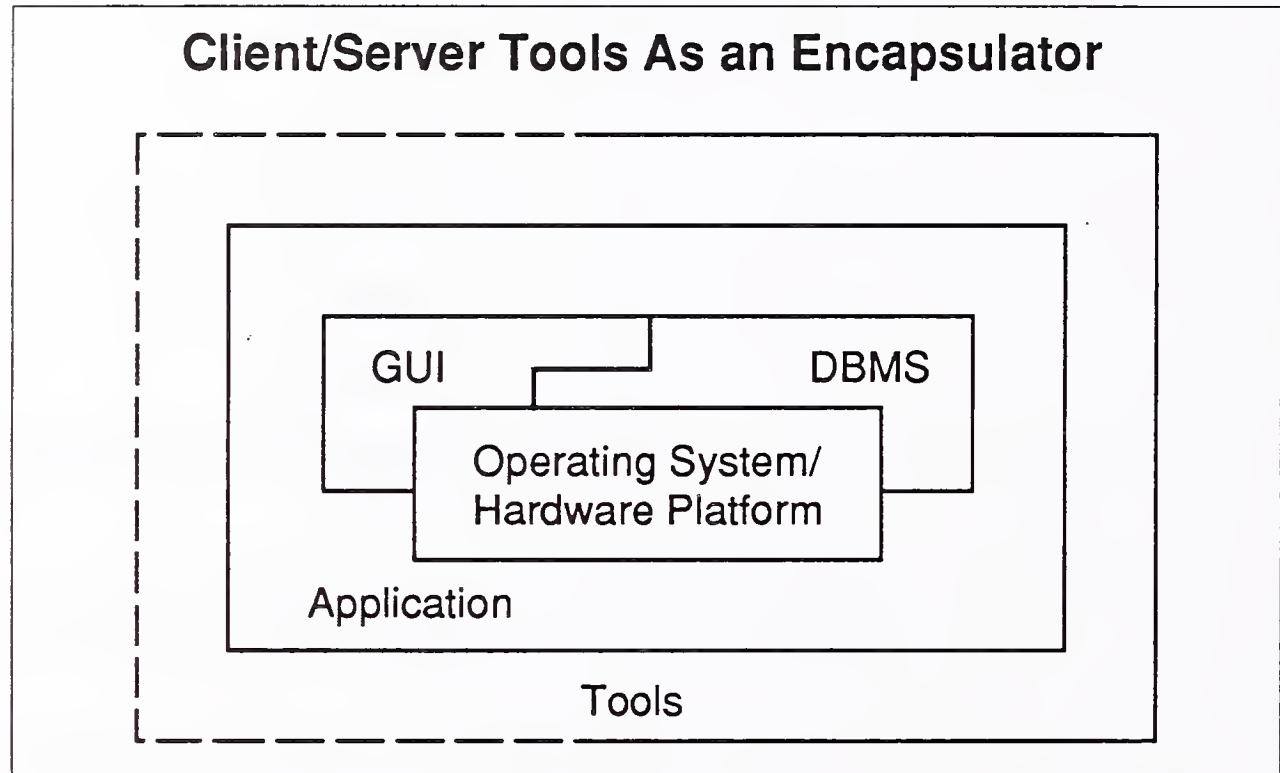
- An individual operating unit in a corporation may not be convinced that there should be a standard, as long as its own particular applications function as intended.
- Decentralization will very likely delay the emergence of de facto standards, since there will be so many more buying points at which vendors can obtain a foothold.

C

Client/Server Application Development Tools

Potentially, client/server application development tools could serve as a means of “encapsulating” the client/server environment and isolating developers from complexities (Exhibit V-7). However, as the dashed line in Exhibit V-7 indicates, this kind of capability does not exist yet in a single tool.

EXHIBIT V-7



Instead, what exist are individual tools, each of which provides some part of the answer.

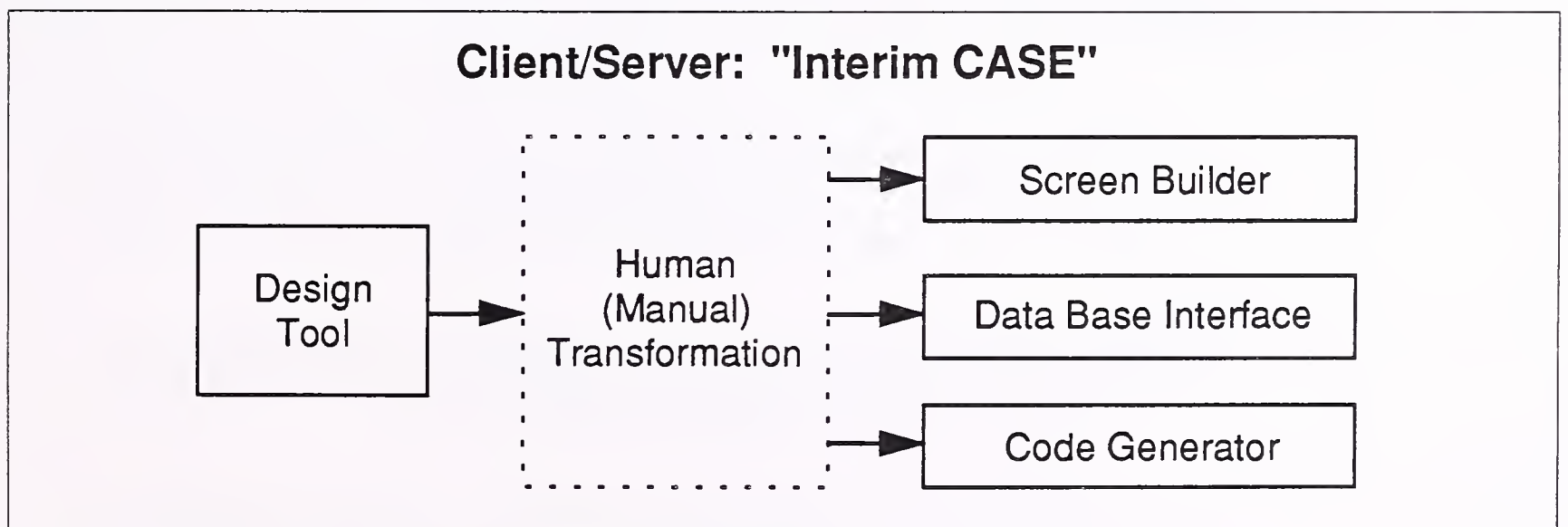
- PC-based design tools can help to capture requirements.
- There are individual programming tools that can assist in screen building, interfacing to data base and generating code. However, no one tool covers all these areas (see Exhibit V-8).
- No tool exists that enables design information to be automatically carried over into the implementation section.

EXHIBIT V-8

Client/Server Tool Snapshot		
Tool	Vendor	Focus
Ellipse	Cooperative Solutions	Transaction Processing
Easel	Easel	GUI/DB
SQL	Gupta	DB-oriented
Viewpoint	Knowledge Ware	GUI/DB
SQL Server	Microsoft	DB/Transaction
Mozart	Mozart Systems	GUI
Powerbuilder	Powersoft	DB-oriented

Exhibit V-9 illustrates this “interim CASE” situation. Client/server “CASE” capabilities are about where those of “host-led” CASE were in the mid-1980s. However, it would be a mistake to assume that client/server CASE can easily build on host-led CASE’s experience and facilities and quickly catch up:

EXHIBIT V-9



- There is no de facto dominant platform toward which to target development, unlike the IBM and DEC platforms in the 1980s.
- The problems in encapsulation are very large—i.e., which client/server components should be pursued? No vendor has the resources to pursue very many options.
- This problem of choices is accentuated by the fact that most of the current providers of client/server application development tools are small firms, as illustrated in Exhibit V-8.
- The established CASE vendors have been quite slow to address the client/server market. Partly, this has been over a past unwillingness to cannibalize existing customers and prospects. However, there are larger substantive issues also involved, such as lack of a firm methodological underpinning.

The current generation of client/server application development tools are just that—individual tools. There is no unifying vision based upon an implicit or explicit methodology. IEF (from Texas Instruments) and AD/Cycle (from IBM) are examples of such concepts with unifying implicit methodologies. It was the cohesive methodology, as much as the implemented technology, that fueled much of the initial popularity of IEF and AD/Cycle.

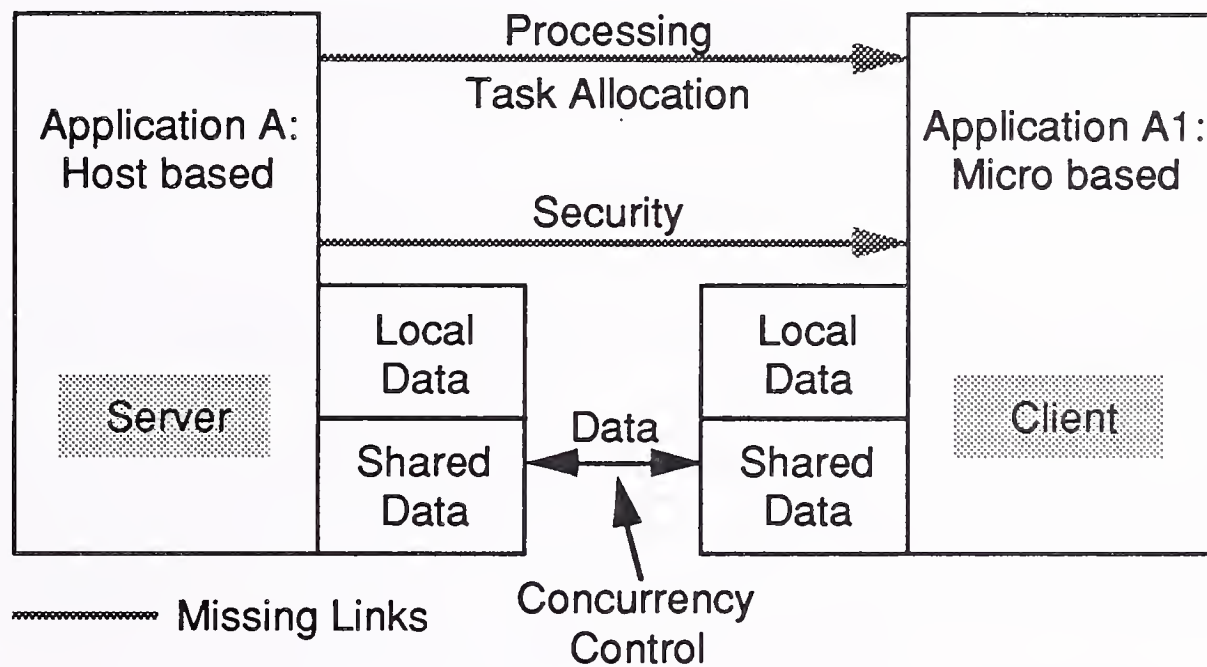
Existing design and data base tools, for example, provide no assistance in allocating processing tasks among different processors in a client/server network. Similarly, there is little assistance provided by allocating data to different parts of a distributed application (either common data or segmented data).

- These are very difficult problems which could, perhaps, be addressed by building up a data base of actual applications, how and why they were segmented, and what the effects of segmentation are. An AI-like advisor could provide assistance in designing and implementing similar applications.
- However, there is no sign that this is occurring. Instead, applications designers must rely on experience, insight and inspiration. Few systems applications developers are strong in all these areas.

Unfortunately, these are longstanding problems. Exhibit V-10 is a reprint of an exhibit from a 1984 INPUT report. INPUT has followed these issues since then and has found little sign of substantial progress.

EXHIBIT V-10

Distributed Design Still Not Solved! Shared Functionality: Missing Links



Source: 1984 INPUT report (shaded areas added in 1992)

D

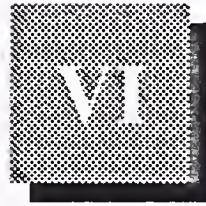
Conclusions

There is an objective need for client/server CASE tools. However, the takeoff stage (i.e., similar to 1989-91 for host-led CASE products) is still several years away.

- Critical conceptual problems still must be addressed.
- Strong vendors need to emerge.
- Client/server platform components have to become simplified either by:
 - Vendors dropping out and/or
 - The emergence of de facto leaders and/or
 - Agreement upon and adherence to standards

A very real alternative to "retail" client/server CASE is for most client/server application development to occur "off-stage," either embodied in applications software products or as part of the systems integration delivery mechanism.

Blank



Market Forecasts

The following factors must be taken into account when forecasting the CASE product market:

- Target platforms used to 1997
- Technical capabilities and effectiveness of classes of CASE products
- Organizational readiness to use CASE
- The degree of potential variability of prior assessments

A

Target Platforms

For CASE it is important to distinguish target platforms for new mission-critical applications, as opposed to new secondary applications, modifications to heritage/host-led applications or personal productivity applications.

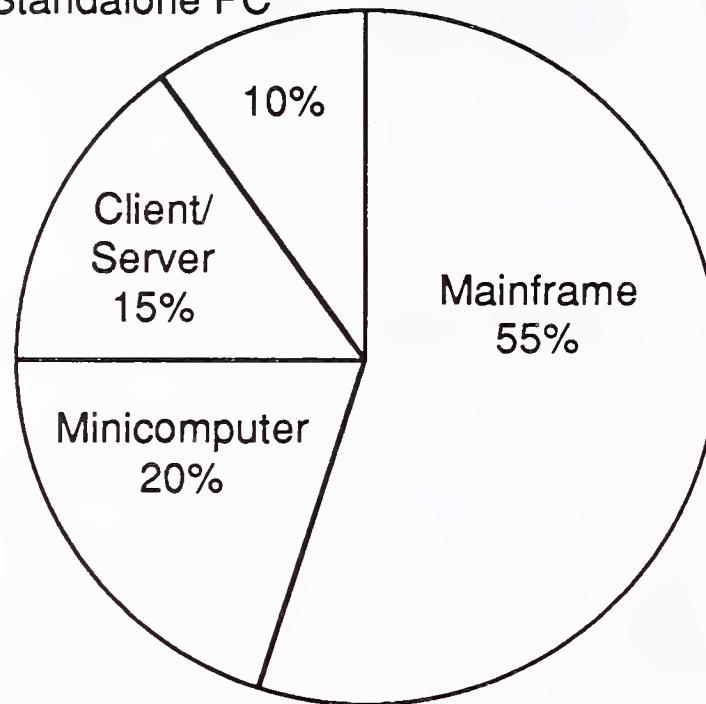
Exhibit VI-1 shows INPUT's estimate for the changes in platform focus for mission-critical applications. Although it is large, the client/server proportion is not greater because:

- Some applications will not be appropriate for client/server, even in the late 1990s.
- Satisfied users of host-led solutions will not always switch, even if the alternative is theoretically an improvement.
- The lack of good tools and concepts will further delay switching.

EXHIBIT VI-1

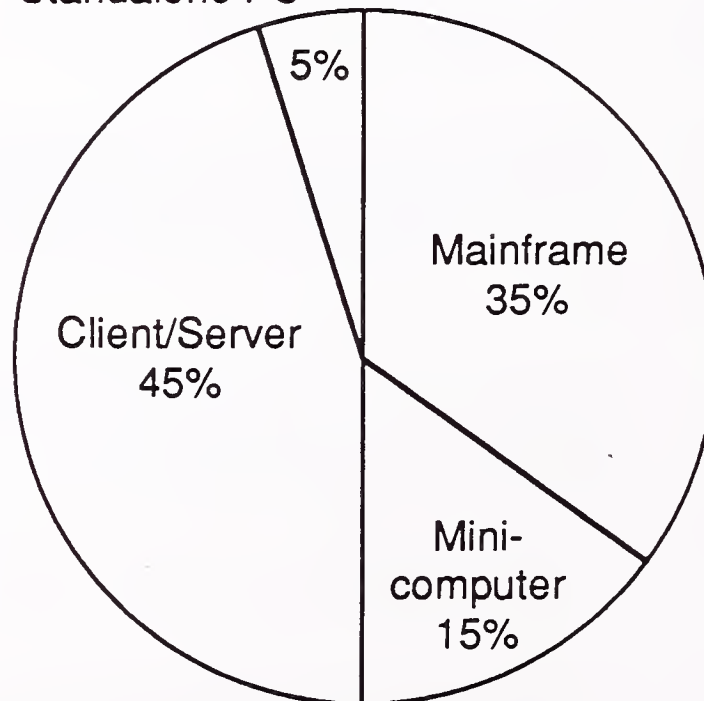
**Target Platform for New
Mission-Critical Applications: 1992-1997**

Standalone PC



1992

Standalone PC



1997

Source: INPUT Estimates

INPUT does believe that by 1997 the client/server model will be superior by most measures (see Exhibit VI-2).

EXHIBIT VI-2

“Grades” for Host-Led and Client/Server Environments

Environment	User Preference		Platform Capabilities		Platform Stability		Software Engineering Support	
	1992	1995	1992	1995	1992	1995	1992	1995
Host-Led	C	C-	B	C-	B+	B	C	B to D
Client/Server	B	A	C	A	C-	B	D-	C to D

A= Excellent, F = Fail

B

Technical Capabilities of Host-Led and Client/Server CASE

INPUT believes it is unlikely that client/server software engineering support (CASE in its widest sense) will have caught up with host-led CASE, even by 1997.

- However, even if host-led CASE does improve markedly, INPUT does not believe that this will counterbalance the other attractions of the client/server model.
- There is also a reasonable likelihood that host-led CASE capabilities will in fact decline during this period. The shrinking market will reduce product improvements at the same time that customer expectations are rising.

C

Organizational Readiness for CASE Use

Organizational readiness to use CASE is not likely to be appreciably different in 1995 than it was in 1991. Even the “best case” is not very good, as shown in Exhibit VI-3.

EXHIBIT VI-3

Host-Led CASE Organizational Readiness Factors: 1991 and 1995

Factor	1991	1995	
		Most Likely	Best
• Culture/organization changes			
- Understanding of general issues	C-	C	C
- Specific environment issues	C-	C	C+
• Methodologies			
- Evaluation criteria	C	C	C+
- Integration into specific environment	C	C	C
• Measurement			
- Definition of success	F	F	D
- Conducting measurements	D-	D-	C-
• Implementation			
- Understanding success/failure factors	D	C-	B-
- Planning	C-	D	C
- Applying success factors to specific environment	D	C-	C
• IS-User Relationships			
- General requirements	C-	C-	C+
- Specific restructuring	C	C	C
• Training			
- Understanding general needs	C-	C	C+
- Developing methodologies	D	D	C-

A= Excellent, F = Fail

Note: See Appendix A for similar 1991 and 1993 assessments.

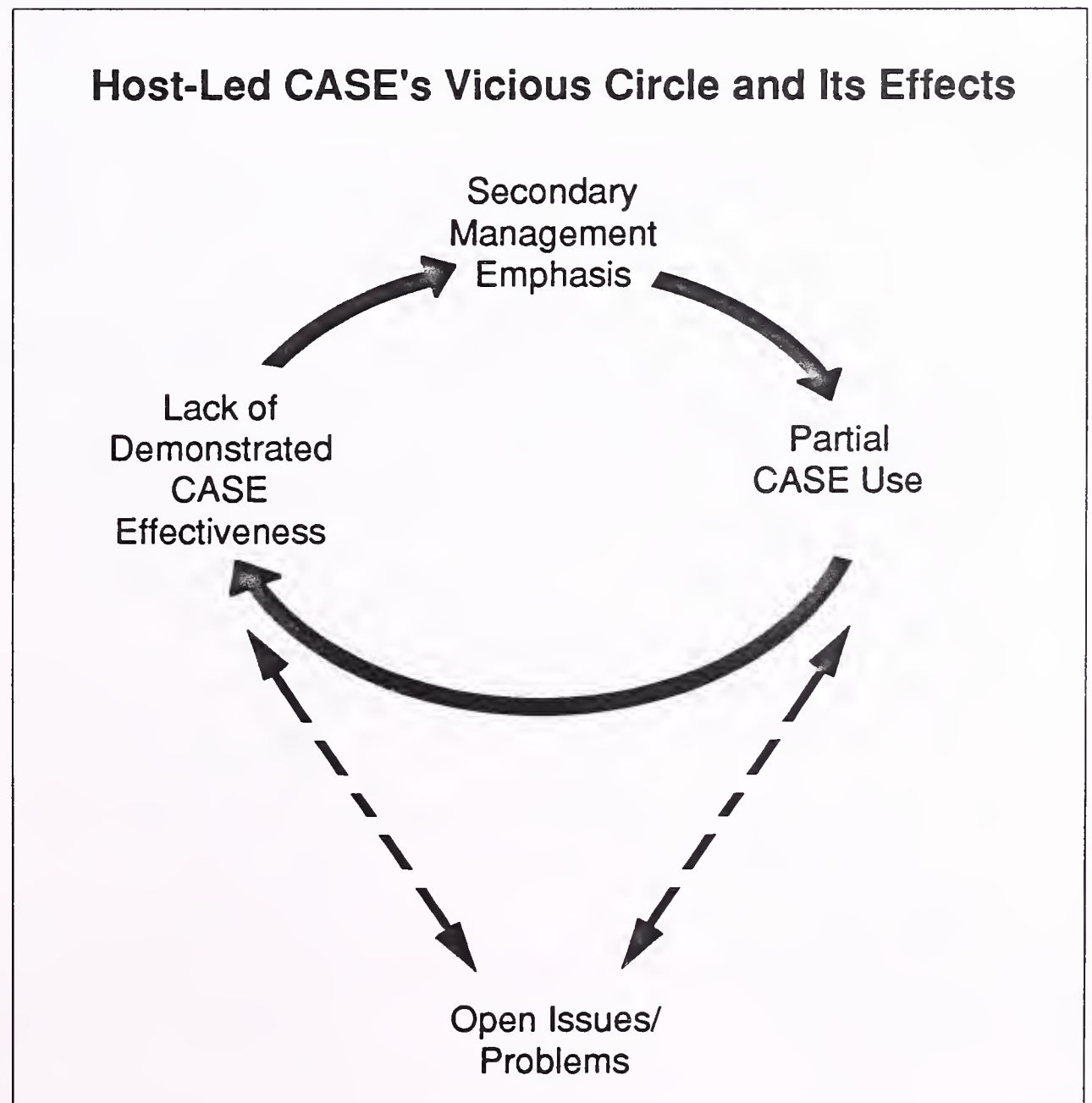
In 1991, INPUT prepared a similar chart: the 1993 “best case” was mostly “A’s” and “B’s.” The difference is that neither vendors nor IS departments have taken many steps to improve readiness; meanwhile, the general capability of IS departments has declined. (See Appendix A for further details.)

Readiness to use client/server CASE will be no better than for host-led CASE.

- Motivation may be somewhat higher in departments.
- However, the ability of user departments to absorb and use technology will generally be lower than for central IS departments.
- The underlying technology of client/server CASE is not well defined or easy to use compared to host-led CASE.

CASE’s vicious circle is expected to continue (see Exhibit VI-4).

EXHIBIT VI-4



D

Major Variables

CASE product forecasts are especially prone to variability because the following factors could change over the next five years:

- Host-led development
- Client/server methodology
- Client/server products
- Underlying client/server technology
- Organizational readiness

Exhibit VI-5 shows INPUT's assumptions about the degree of variability inherent in each factor.

EXHIBIT VI-5

CASE Acceptance Variables

Factor	Degree of Variability	Issues/Comments
Decline of host-led development	Narrow	• Trend is strong; current CASE orientation
Lack of client/server software engineering methodologies	Wide	• Successful and accepted concepts could drive C/S CASE
Lack of client/server CASE products	Medium	• Medium-term directions clear • Long-term depends on methodologies
Uncertainties of underlying C/S technology	Medium	• Software robustness • DB control • Competing standards
Organizational readiness	Wide	• Will end users be more willing and able to use CASE?

E

CASE Product Forecast

Exhibit VI-6 shows the CASE product forecast in three scenarios. The growth rate by year for each scenario is shown in Exhibit VI-7.

EXHIBIT VI-6

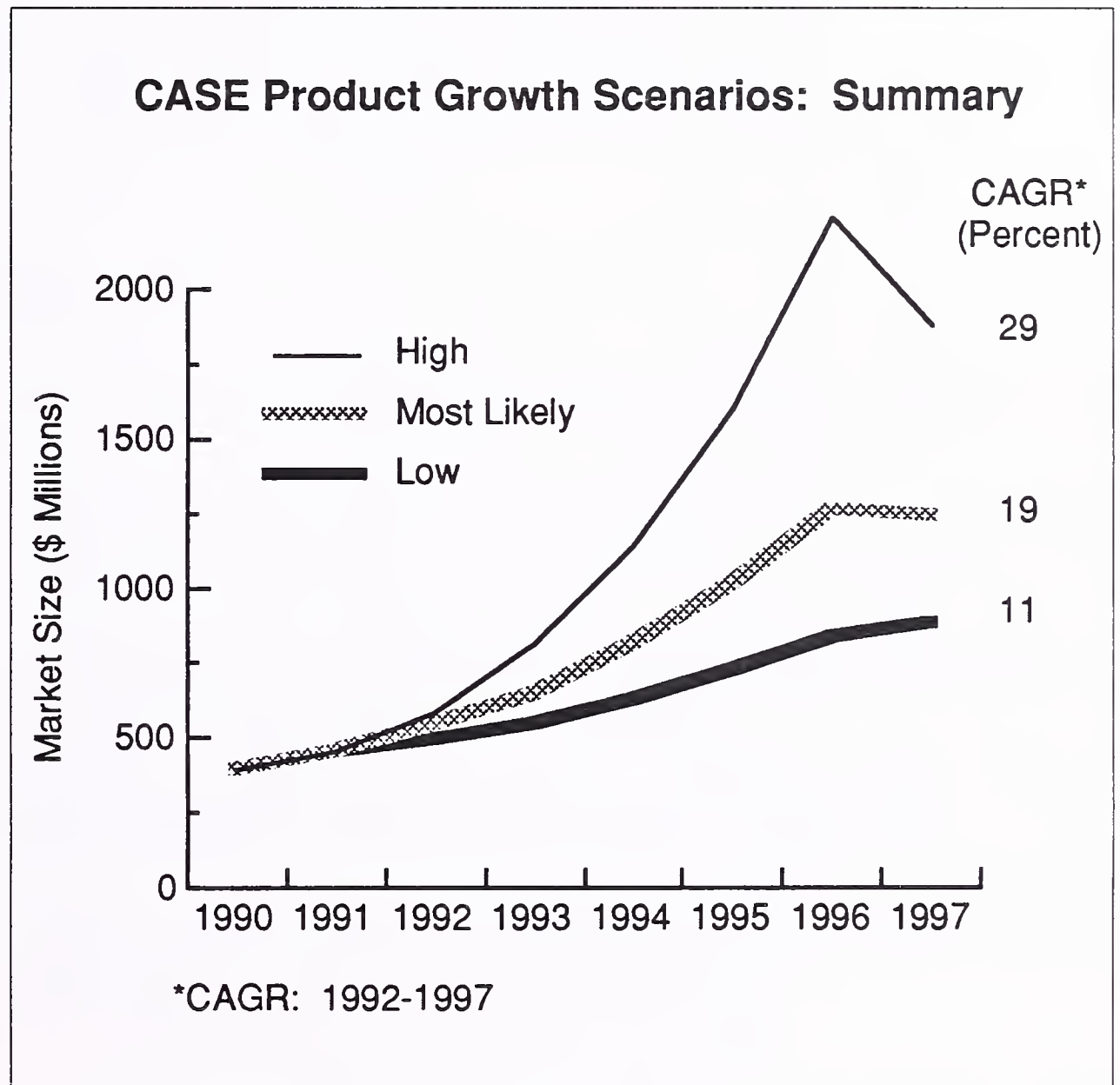
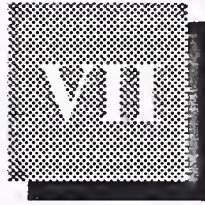


EXHIBIT VI-7

CASE Product Growth Scenarios: Numerical Summary

	Scenarios					
	Low (\$ M)	Growth (Percent)	Mid (\$ M)	Growth (Percent)	High (\$ M)	Growth (Percent)
1990	390	-	390	-	390	-
1991	450	15	450	15	450	15
1992	520	15	520	15	520	15
1993	600	15	600	15	620	20
1994	660	10	720	20	740	20
1995	730	10	860	20	960	30
1996	800	10	1,030	20	1,340	40
1997	880	10	1,240	20	1,880	40

For comparison, the forecast made in 1991 is shown in Appendix B. Growth now is essentially on the lower growth curve set in 1991 because demand and ability to utilize the products fell below expectations for the reasons given in the 1991 analysis.



Conclusions and Recommendations

A

CASE Product Environment

The CASE product environment has undergone extensive changes in the past two years, more on the demand than the supply side.

- The demand for CASE products in the host-led environment is no longer growing at a robust pace. It is unlikely that the levels of growth of 1989-1991 will be seen again.
- The near-term limits on client/server CASE are technological: methodologies and related tools are the chief need now.
- Longer term, client/server CASE will run up against the same organizational readiness limitations that have stymied host-led CASE.

Suppliers that are now predominantly oriented toward host-led CASE will have to re-orient themselves even faster to client/server CASE if they are going to grow.

B

Changes in Development Practices

In the medium term there will be need for different types of skills in applications development, depending on the target environment. Exhibit VII-I shows the four major types of development groups operating in the three target environments. The focus will be quite different for each.

EXHIBIT VII-1

Downsized Development Environments

Target Environment	Application Developers			
	Power User	SI Vendor	Centralized IS	Decentralized IS
Host-Led		XX	XX	X
Client/Server	XX	XX	X	XX
PC/Workstation	XX	X		XX

XX = Very Important, X = Important

C

Changes in the CASE Product/Service Mix

Until now CASE has been primarily product oriented—a very technical product sold to technicians. These practices should be re-examined:

- Given the increased importance of user departments in applications selection, should CASE still be viewed as a “technical sell”? Should CASE vendors reposition CASE technology as a means of communication between developers and business knowledge holders?
- Can CASE still be “sold” on a “retail” level by vendors to developers inside corporations? Given the dispersed, semi-technical nature of the emerging IS environment, is this cost effective or useful?
 - Vendors should consider the advantages of building CASE into applications products that can then be tailored for a specific user’s needs.
 - Similarly, CASE product vendors should turn to professional services/ systems integration vendors to be the chief user of CASE. CASE products would then be sold indirectly to the ultimate user via a solutions provider.

D**The Need for Externally Provided Software and Services**

Many of the hopes and expectations for CASE in the corporate environment have not come true. However, the need for quickly developed, robust systems is higher than ever.

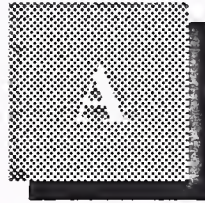
The current range of products and services offered by vendors can be "enriched" by CASE technology and concepts. Exhibit VII-2 shows the range of "CASE-enriched" products and services that can be offered. The level of demand is often influenced, whether or not there is a strong central IS function.

EXHIBIT VII-2

"CASE-Enriched" Products and Services

"CASE-Enriched" Product/Service	Strength of Need In:	
	Strong IS Department	Strong User Department
Client/Server Planning	High	Medium
Requirements Analysis	Medium	High
Software Product Evaluation	High	High
Supplying Systems Software Products	High	Medium
Supplying Applications Software Products	Medium/High	Very High
Software Product Installation & Support	Medium/High	High
Application Implementation	Medium	High
Systems Integration	Medium	High

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Organizational Readiness Assessment in 1991

1. Near-Term Issues (1991-1993)

There are two sets of near-term issues affecting market growth:

- Technology-related issues
- The “soft” issues (described in Exhibit III-10), which affect the extent to which an organization is ready (“organizational readiness”) to absorb and make productive use of CASE.

Based on INPUT’s research, these organizational readiness issues are even more important than the technology issues. Exhibit V-2 contains INPUT’s assessment of a number of the organizational readiness issues for both 1991 and 1993 (a best- and worst-case assessment is provided for 1993).

- The sum of the “grades” for 1991 reflects near failure. This puts into perspective the earlier findings on the overall relative ineffectiveness of CASE (e.g., Exhibit III-3).
- The sheer number of such factors needing improvement will make progress relatively difficult; yet all the factors are important, and it is difficult to make a case that some can be ignored at the expense of others.
- The worst-case total for 1993 shows little improvement over 1991.
- The best-case total would virtually guarantee CASE success in a wide variety of settings.

INPUT concludes that in the near term, organizational readiness may serve as the most serious constraint to CASE progress.

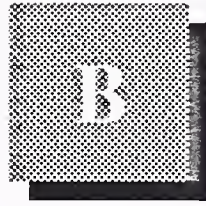
EXHIBIT A-1

CASE Organizational Readiness Factors: 1991 and 1993

Factor	1991	1993	
		Worst	Best
• Culture/organization changes			
- Understanding of general issues	C-	C	B+
- Specific environment issues	C-	C	A
• Methodologies			
- Evaluation criteria	C	C	A
- Integration into specific environment	C	C	B+
• Measurement			
- Definition of success	F	D	C+
- Conducting measurements	D-	D-	B-
• Implementation			
- Understanding success/failure factors	D	C-	B+
- Planning	C-	C-	B+
- Applying success factors to specific environment	D	C-	B+
• IS-User Relationships			
- General requirements	C-	C	B+
- Specific restructuring	C	C	B+
• Training			
- Understanding general needs	C-	C+	B+
- Developing methodologies	D	D	A

A= Excellent, F = Fail

Source: INPUT Assessment



1991 Forecast: Extract from 1991 Report

1. Application Environment Forecasts

In 1991, about one-third of application development could use CASE tools. By 1996, potential CASE focus will have almost doubled. Even more important, the greatest need and opportunity will be in the re-engineering areas.

Even if CASE does not have much to offer multiple peer applications and they still have to be built the “old-fashioned way,” this will only be a secondary issue to vendors and most IS organizations.

This highlights the importance of re-engineering to CASE users and CASE vendors.

2. CASE Product Growth

The CASE market's future growth will be heavily affected by the following:

- Near-term considerations will be heavily influenced by organizational readiness.
- Medium-term growth will be greatly influenced by developments in re-engineering techniques.

Exhibit B-1 (and its backup, Exhibit B-2) show the three scenarios:

- INPUT considers the middle scenario the most likely: adequate, but not maximum, progress in organizational readiness and re-engineering.
- The “low” scenario essentially encompasses a lack of further advances in CASE. CASE will continue to grow but in a non-strategic mode that is oriented mainly to technical staff.
- The “high” scenario assumes that both the “soft” and “hard” issues are resolved satisfactorily. Growth might in fact be even higher if not for limitations in training, staffing, and the general ability of organizations to absorb CASE techniques.

EXHIBIT B-1

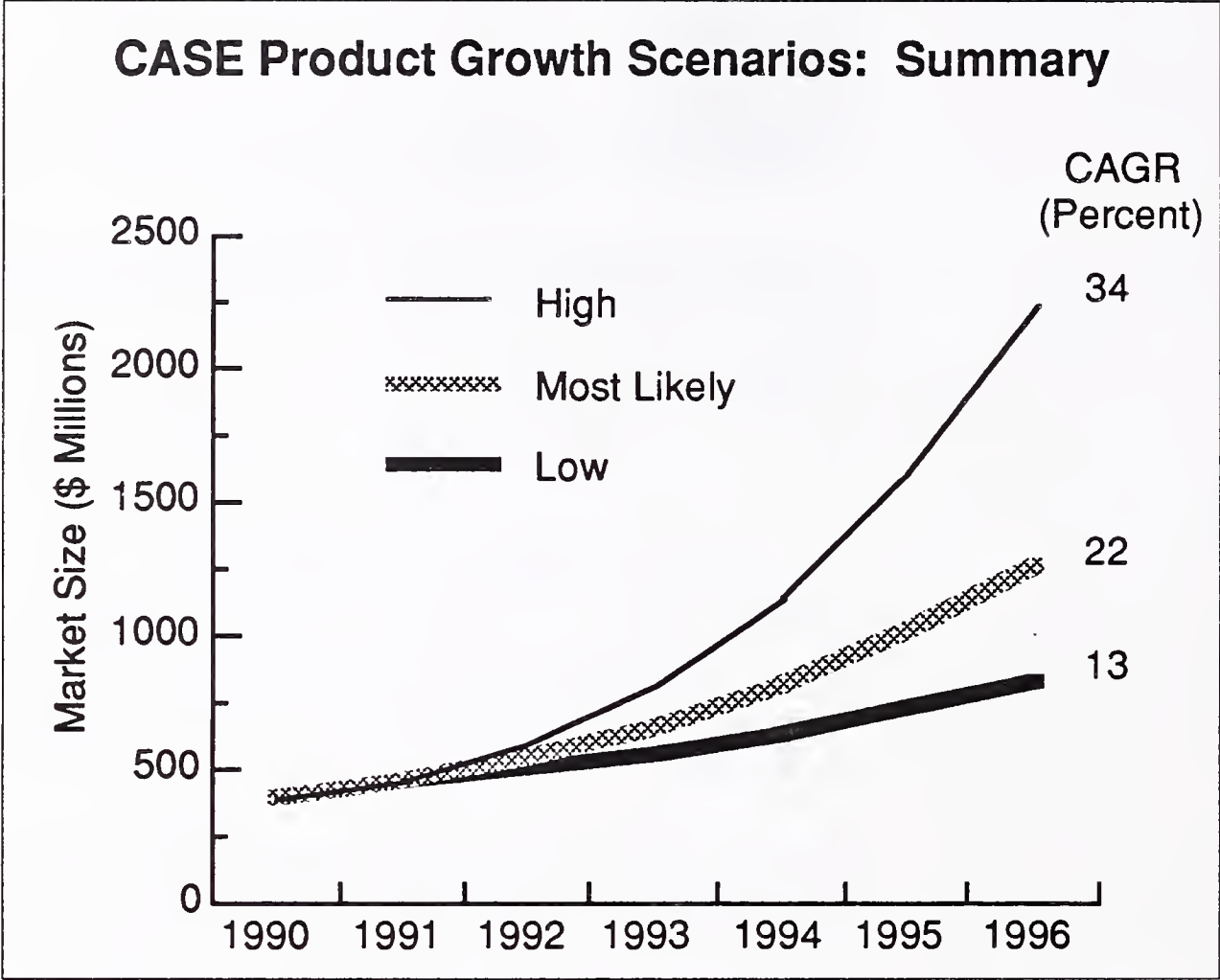


EXHIBIT B-2

CASE Product Growth Scenarios: Numerical Summary

	Scenarios					
	Low (\$ M)	Growth (Percent)	Mid (\$ M)	Growth (Percent)	High (\$ M)	Growth (Percent)
1990	390	-	390	-	390	-
1991	450	15	450	15	450	15
1992	495	10	540	20	585	30
1993	545	10	645	20	815	40
1994	625	15	810	25	1,140	40
1995	720	15	1,010	25	1,600	40
1996	830	15	1,260	25	2,240	40

